FACTORY

ANAGEMENT AND MAINTENANCE

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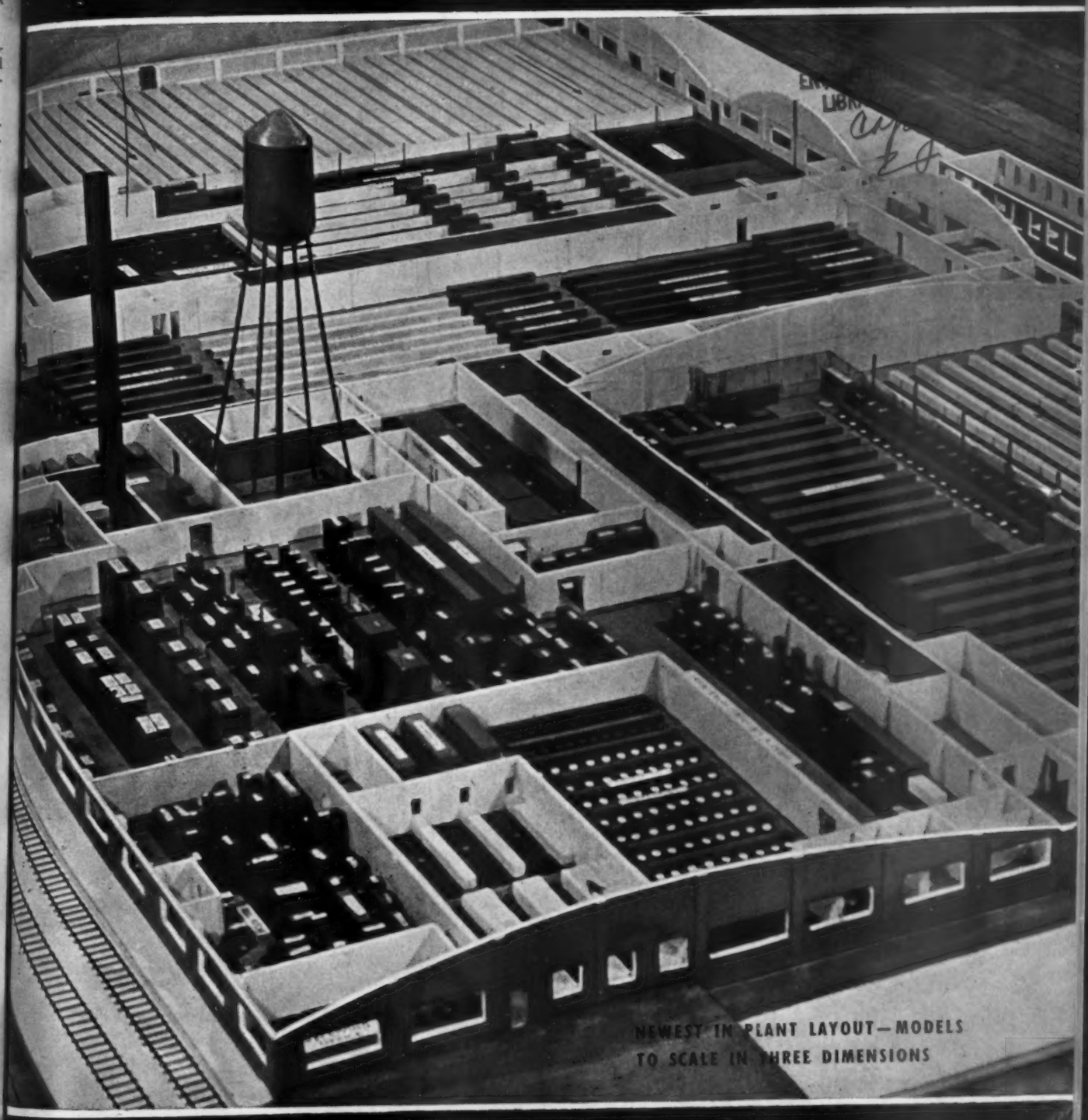

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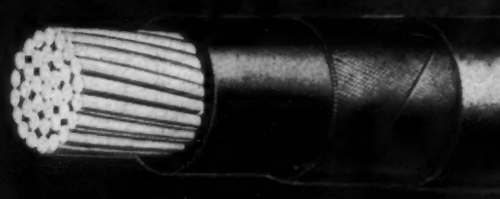

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MANAGEMENT AND MAINTENANCE

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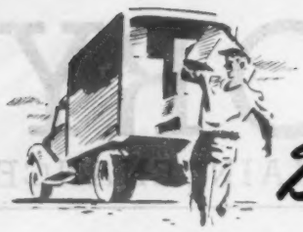

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REDEDICATION

An Obligation to Our Fighting Men

During the last few weeks we have been forcibly reminded that so long as we still are fighting either of our major foes, first claim upon the productive resources of the United States—its manpower, materials, utilities, and industrial facilities—must be the production and delivery of munitions and war supplies. All other claims are secondary. No responsible citizen would have it otherwise. For in this war even more is at stake than our existence as a Nation. We dare not forget that we are engaged in a struggle that challenges the fundamental values upon which our civilization has been built.

It is not easy to list the values that we are fighting to uphold. They have been clothed in a variety of shapes over the centuries. They will assume new forms in the years ahead. But they have an inner consistency that free men the world over can feel and recognize: the right of the commoner against the noble, the right of the individual against the state, the right of trial by jury, the right to vote, the right to an education, the right to freedom of speech and worship, the right to work in a sphere of one's own choosing, the dignity and the equality of the individual under the law—these are our cultural heritage, painfully won and often precariously held over the ages, always to be rewon, redefined and buttressed by each succeeding generation of men.

The preservation of this vital core of value, and its transmission to our sons and daughters depends upon our victory in this struggle. So those things which are essential to victory must come first. And since the production of war munitions in overwhelming volume and quality can hasten that victory and save countless lives of our fighting men, no effort that will contribute to this end should be regarded by us as a sacrifice.

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The present is no time for self-congratulation upon our achievements either in the theatres of battle or of production. The mounting casualty lists should suffice to curdle the savor of any such indulgence. The most that can be said in reasonable taste and good conscience is that performance in both fields is such as to warrant our firm confidence that we can carry to successful completion the tasks that remain to be done.

Nor is there profit in even observing, much less deploring, that the tasks ahead are more formidable than those which were defined for us a few short months ago. Then, all of us—military leaders, government officials, workers, and business men—were riding a crest of optimism as to an early end of the war in Europe and as to the character and dimension of the war against Japan. Already we had begun to turn anxiously toward the problems of reconversion which then seemed so near at hand. Schedules for war production, based upon the best available estimates of need, called for a 5 billion dollar reduction from 1944 performance, even though we might have to continue a two-theatre war, and for a 40 percent reduction in the event of an early victory in Europe.

Today, those forward estimates have been revised sharply upward. That is true both of the 1945 requirements to meet the needs of a two-theatre war, and of requirements for the Pacific war once the European phase is ended. For this upward revision four chief reasons are responsible:

1. European battle experience has shown markedly greater use of expendable munitions than was provided in the formulae upon which our original production schedules were calculated: the result has been a depletion of inventories on a scale that would become dangerous if allowed to continue.
2. Experience has also demonstrated the need for new types of weapons or increased complements of some existing types to match new enemy equipment or tactics.
3. A less easy optimism as to the early ending of the European war has given rise to a growing disinclination to gamble on the approximate date.
4. An increasing conviction prevails that the war against Japan may require ground-army operations on the Asiatic mainland on a scale greater than originally premised.

But if these changes in the fortunes and outlook of war have raised our estimates of military requirements, may not subsequent favorable changes in the military situation cause them again to be revised downward? It is entirely possible. But our military men have learned that they cannot safely discount what *might desirably happen* as something that *will happen*. Those working on the production front also must learn that lesson. Fortunately, the record shows that we have been able to maintain a war production almost equal to that of the rest of the world combined, even while we produced for civilian use on a scale that has been large even by our

own pre-war standards. So we have ample margin to whip whatever war job may be required of us. As now defined, the task will not be easy. But it *can* and *will* be done.

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What, then, is the production task with which we are charged? Our 1945 production for the two-theatre war now calls for the substantial maintenance of the over-all levels reached in the latter months of 1944. But there is a shift of emphasis. Almost half of the programs for specific equipment items are declining. A few are scheduled to hold level. About 45 percent are scheduled to rise sharply. That means that workers and facilities must be shifted to man the expanding programs. At the same time the armed services are calling for many more men than can be supplied from those who become newly eligible to the 18 year old age group. That means further drafts upon war workers. It means also replacements for them when they are taken from the expanding programs. Finally, events demand that we produce as much as possible of many items during the first half of 1945.

Our task, then, is one of intensified effort for the immediate future, with multiple readjustments at a stage when adjustments are hard to make. Materials for which demand was easing as pipe-lines were being drained in anticipation of falling schedules again are tight as the pipe-lines are being refilled to meet augmented requirements. Men, women, and facilities must be shifted from less essential to more essential tasks. What must be done will be done. But unless there is much voluntary accommodation, it will be necessary for us to suffer a formidable amount of governmental direction which none of us likes, many of us deeply resent, and all of us, when personally affected, volubly protest. The more we police ourselves, the less we shall be policed.

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Even after Germany has been defeated, we shall still face a far from light production requirement to continue the war against Japan. As currently defined this phase might require war expenditures at something like $70 billions a year, an over-all reduction of approximately 20 percent from the $89 billions spent in 1944. Reduction in munitions output would be somewhat greater, probably from 25 percent to 30 percent below 1944 levels. But it is important for us to acknowledge that the reduction is going to be substantially less than the 40 percent previously estimated.

Only a few months ago there were those who questioned sharply the possibility that we might need 60 percent of current munitions output to win the Japanese war. Now the judgment of the military is that 70 percent will be none too high.

Actually the latter level would represent an increase of little more than 50 percent above what now is being produced for the Pacific area. This, certainly, is a modest estimate when we reflect that we shall inevitably more than triple the Army forces assigned to that theatre.

Such a program probably would give us a current munitions supply from three to four times that produced by Japan, but it is believed that we shall need that much to compensate for the advantages derived by Japan from the fact that she will be fighting a defensive war, from the volume of her accumulated stores, from her prepared positions, her shorter lines of supply and transport, and from her large troop reserves, the bulk of which we have yet to meet in battle. Certainly our present 3 to 1 production edge over Germany does not appear to be excessive.

The more modest V-E Day cuts contemplated by the present plan will mean a less acute reconversion problem when they are made, but will leave a greater one to be met at the end of the war. They will mean probably a net increase of not more than 4 million workers available for civilian work during the transition period. Their orderly absorption should present no embarrassing problem. Indeed, we now are warned by Washington that war production following V-E Day may require the protection of considerably closer control than was contemplated under the 40 percent cuts previously expected.

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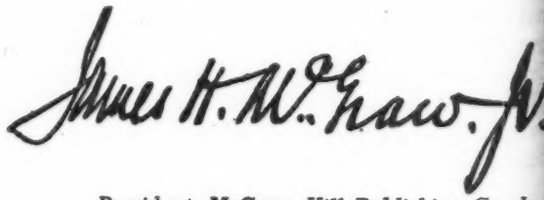
In short, we face for the immediate future a more difficult production job. It is made the more formidable by the fact that we had dulled the keen edge of our will to produce by our premature expectation of a reduction in requirements. Now we are told that the trend of war production for the immediate future is up, that it is unsafe to discount the date of victory in Europe, and that the amount of leeway for reconversion after the defeat of Germany is less than had been anticipated.

Accordingly, we must rededicate ourselves to the task of driving war production up. We must do without some of the things that we have enjoyed on the civilian front rather than demand more of those things; we have still to devote our abilities and energies first and foremost to the demands of war.

Whatever will assure and hasten victory must have first place in any statement of American policy.

Without victory, our aims, and the underlying values upon which they are based, will be extinguished, blotted out by the opposing aims and values proclaimed by our enemies.

The needs of our fighting men must be put first. For, unless we win the war, the National aims and policies of the United States will cease to have meaning in the world.



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THIS IS THE 32ND OF A SERIES

FACTORY
MANAGEMENT AND MAINTENANCE
L · C · MORROW · EDITOR

This Way Labor Peace?

Being considered by the British Parliament is a proposal described in a cabled dispatch to the *New York Times* as a bill that "aims to provide a foundation for goodwill and cooperation between employers and employees, first as an essential for industry to make the most of its productive capacity, and secondly for the sake of an expanding economy to uphold the worker's purchasing power as represented by his wages."

These two objectives long have been sought by an earnest minority in this country—a minority drawn from industrial management, organized labor, government, and economists. This minority advocates high wages because of the purchasing power they represent and therefore because of their contribution to standard of living. But it believes that high wages must be accompanied by high output per worker or they cannot be paid under our economy.

When it calls for higher and higher output per worker, as wage rates are raised, it is not calling for more back-breaking or nerve-destroying physical toil. It is calling for (1) on management's part never-ending technological development to make possible greater output per worker, and (2) on the worker's part full cooperation to see that the fruits of technological development are allowed to ripen and become available for higher standard of living.

According to the report in the *New York Times*:

1. The bill proposes measures to obtain standard wages and conditions of employment in all branches of British industry.

2. It also puts the power of law behind voluntary agreements between employers and employees concerning wages and working conditions. (Where an agreement has been made between a union and an organization of employers, an individual employer must accept the terms of the agreement whether or not he is a member of the organization.)

3. Ernest Bevin, Labor Minister, whose bill it is, describes it as a declaration by Parliament that "the day, or at least the conception, of what is known as the sweated industries, is past."

4. Arthur Greenwood, leader of the Parliamentary Labor party, in supporting the bill, said that he would like to see wages eliminated altogether as a competitive factor in industry, so that success in business would result from superior management efficiency.

Is Britain, by this proposed legislation, approaching the solution to the labor conflict? Usually accredited with being 20 years ahead of the United States in labor-management relationships, she had nevertheless no record to be proud of in 1944. Disclosed recently is the fact that Britain, in the first 11 months of 1944, lost 3,648,000 man-days of work through labor disputes in comparison with 1,810,000 in 1943—more than during any one of the preceding 12 years.

This record, and the new legislative attempt, in a country so far advanced in labor matters, raise some serious questions: Has real progress in labor relations been made? Will the unnecessary conflict between labor and management ever stop? Is it an unnecessary conflict, or must it go on to stimulate progress by the painful route we all know so well?

No one could ask for a finer objective than "first as an essential for industry to make the most of its productive capacity, and secondly for the sake of an expanding economy to uphold the worker's purchasing power as represented by his wages." Everyone will agree that success in business ought to result from superior economic and management efficiency. When shall industry be able to give its full attention to working toward those goals?

The effect of this bill, if adopted, is something the United States must watch with great care. Its objectives we must find some way to achieve, whether by legislation or the only other method I know of—education.

L C Morrow

What Industry Wants to Know About Veterans

3. THE PLANT'S OBLIGATION

Last of three reports on veterans (1. "The Nation's Policy," December, 1944; 2. "The Community's Job," January, 1945). Combined reprints available in a single binding, 50 cents per copy. Address: Editor, *Factory Management and Maintenance*, McGraw-Hill Publishing Company, 330 West 42nd Street, New York 18, N. Y.

PROGRESSIVE MANAGEMENT now recognizes that America—and industry to the full extent of its responsibility—*must* succeed in the delicate task of reabsorbing unprecedented millions of veterans into civilian life.

Failure can spell internal disaster in which the coincident destruction of private enterprise would be a mere detail. Yet it must be remembered that success will depend fully as much on correct methods as on good intentions.

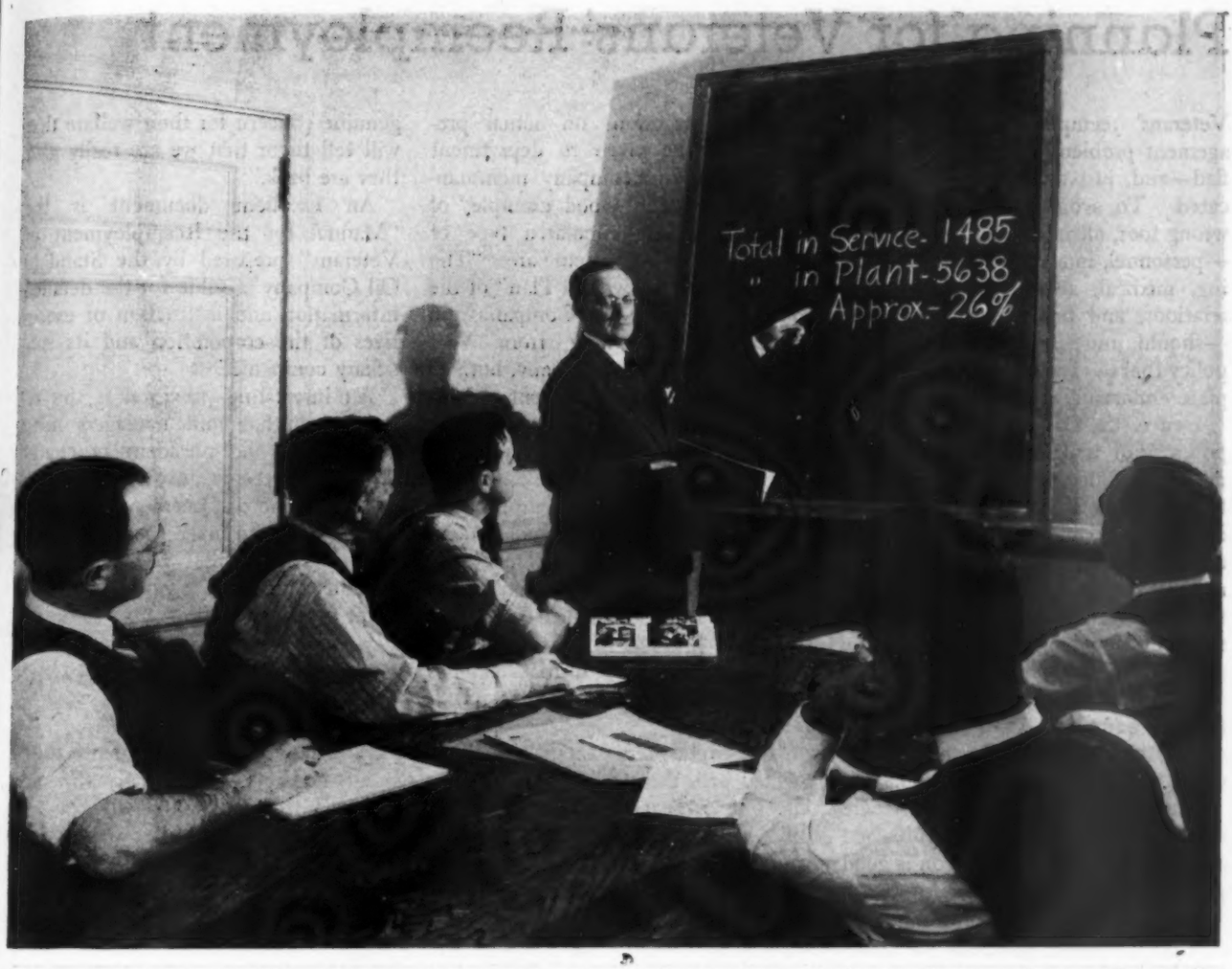
Thousands of industrial companies have created, and thousands more are planning, programs for the reemployment of veterans. Since perspective is the first requisite of accurate planning, FACTORY, in previous articles, has emphasized these points:

1. Reemployment and rehabilitation of veterans is primarily a job for the nation and for the local community in which the manufacturing industries will play a vital but distinctly limited role.

2. Factories will not, because they cannot, reemploy all the veterans, nor should they profess to, lest later they be asked to take the blame for failures not their own.

3. Manufacturing employers will advisedly concentrate, therefore, on the *right placement* of the *right number* of veterans.

4. At all events, there will be no sudden influx of veterans, even after victory in Europe. This is well, in a way, because an influx would find confusion at the community level, tracing to tangled jurisdictional lines in Washington. Excess of zeal among agencies must be resolved.



The principle of providing a veterans' counselor is basic in good plant programs. And because the foreman has vital, day-by-day contact with the veteran, training will pay. Companies are beginning to develop training courses to bring about uniform understanding of plant policies and procedures. In these courses, foremen are instructed in such subjects as the employer's legal responsibility, management's moral obligation, government regulations, supervising the physically handicapped, and so on

5. The principle of providing a community "front door" for veterans now seems fully established. Two examples, Worcester, Mass., and Dayton, Ohio, are cited by FACTORY.

6. Employers must learn not to think of veterans as a "problem." This is said to offset distorted impressions created by too much talk of "psycho-neurosis" and "rehabilitation." On the contrary, veterans represent the most desirable of prospective employees, drawn from the most employable age group, chosen for physical fitness, tempered by discipline, and trained to leadership. Only a small percentage of veterans will be lastingly damaged, physically or mentally, by the war. The percentage of those whose employability will be seriously affected, will be even smaller.

All these observations have been amply confirmed by FACTORY's further study of companies that have been able to compile a certain volume of experience in veterans' reemployment. This helps to bring the question into focus for companies that are still in the "blueprint" stage of planning. And, in this connection, industrial observers urge a careful consideration of *approach*.

For mistakes will, of course, be made. A minority of companies may try to dodge their basic obligations. A minority will rush to the other extreme with smug, showy, semi-patronizing endeavors to "rehabilitate" all the veterans in sight—whether they need it or not. A few employers may even visualize the veteran as a union-busting tool—and it would be hard to say which of these three boomerangs contains the greatest threat to private industry's eventual destiny.

But the vast majority of managements will hew to the line of simple, natural common sense. And it is to them that FACTORY addresses the following review of plant procedures that seem to be good.

CONTINUED ON NEXT PAGE

Planning for Veterans' Reemployment

Veterans' reemployment, as a management problem, can be over-simplified—and, just as easily, over-complicated. To avoid getting off on the wrong foot, all interested departments —personnel, industrial relations, training, medical, advertising and public relations, and production supervision —should unite in concurrence on a policy that has top management's complete endorsement.

Hence the wisdom of getting a policy into writing. Simply putting it on paper and getting people to agree to it has these good effects: (1) It crystallizes practical thinking; (2) it averts long-range mistakes which might not be foreseen if one department's thinking were predominant; (3) it assures uniform understanding of the problem and the policy by all branches of operating management. Finally, it has the additional virtue of weeding out patriotic flapdoodle and getting down to the brass tacks of action.

Some policy statements—and there are scores of good ones—are published and others are not. Publication is good public relations, of course, but more detailed instructions on actual procedure can be given to department heads in an intracompany memorandum or booklet. Good examples of the more widely circulated type of printed policy statement are: "The Veterans' Reemployment Plan" of the International Harvester Company; and "Employees Returning from War Service" by Swift & Company, both of Chicago; and "Reemployment of Veterans," the reprint of an address by Stewart M. Lowry, industrial relations director of Procter & Gamble, Cincinnati, which reviews the reemployment question generally and includes an introductory outline of P & G policy.

A comprehensive memorandum to department heads has been prepared by the H. J. Heinz Company of Pittsburgh with a foreword that includes this worth-while statement by H. J. Heinz II:

"Our returning veterans can be greeted with the attitude, 'Here's your job, but if the government didn't require that we reemploy you, you wouldn't be here,' or they can be welcomed with a spirit of friendliness and genuine concern for their welfare that will tell them that we are really glad they are back."

An excellent document is the "Manual for the Reemployment of Veterans" prepared by the Standard Oil Company of Ohio for the detailed information and instruction of executives of the corporation and its subsidiary companies.

An interesting provision is the requirement that unit managers must refer to the vice-president in charge all major decisions involving veterans —such as the displacement of a civilian employee to make room for a veteran or the refusal to reemploy a veteran who fails to meet reinstatement requirements.

"Veteran New Hires" Seen as Coming Problem

A review of various company statements suggests that industry will emphasize the reemployment of its "own" veterans, making few promises to "veteran new hires." Most managements seem currently inclined to lean

WHAT EVERY PLANT SHOULD DO

1. Think out a policy and put it in writing. Get top management and all interested departments to agree on fundamentals

2. Decide on a program. Assign functions. Make sure program meets minimum obligations plus as much more as can be guaranteed

3. Keep in touch with employees while in service. Welcome them when they return. Show a friendly interest in them on the job

4. Help the veteran choose his job with care. Give him time to settle down. Advise him wisely on questions of readjustment

5. Follow through. Keep records. Check on success of placement, health, training, advancement. Review veteran transfers with care

6. See that all branches of management understand and cooperate on veteran policies and procedures. Make sure that factory supervision is properly instructed in the reception and handling of returning servicemen

7. Don't rush veterans back to work. Men keyed up by overseas and combat experience especially need a "decompression period," before starting new routines

8. Avoid giving the veteran the idea that he belongs to a permanently "different" or privileged class. Real aim of good program is "reconversion" to civilian life

9. Retain a veterans' counselor, a veteran himself, who will represent management to the veteran, help the veteran choose his job, follow through on every detail of placement and transfer, provide the all-important "listening ear," but "tell the veteran off" when he goes out of bounds

Basically good placement procedure is really the same for all employees, veterans or otherwise. The only new element is the veterans' counselor who serves as a sort of "lubricating" force. Not all plants can provide these services, but most can see that the functions are performed by existing staff

over backwards in compliance with the strictest (as applied to management) interpretations of the reinstatement provisions of the Selective Service and Training Act and to try to resolve them with existing seniority provisions in union agreements.

Inescapably the "veteran new hire" looms as a source of friction in layoffs (as suggested in "The Ranger Case Highlights Coming Conflicts—The Seniority Tangle," FACTORY, April, 1944). This is confirmed by more recent experience. Several hundred veteran new hires were caught in a layoff in an eastern plant not long ago. They left without much fuss because other jobs were still plentiful, and USES recruitment officers were present in behalf of neighboring plants.

But grumbling was heard, nevertheless, about the fact that women were being retained in the layoff, foreshadowing future, more bitter quarrels between the "new" veteran and the woman with seniority status—and occasionally between such veterans and male civilians. Seniority provisions may stand up, however, for two reasons: (1) Many managements are inclined to string along with them, with all their faults, as the only thing resembling a workable measure of job-priority; (2) the unions can contend more successfully than they could a year or two ago that to insist on seniority is to protect the jobs of union members still in service.

All veterans apparently tend to feel a certain special right to a job, however, and to express impatience with what seem to them to be technicalities. Among other things, this is a cogent argument for keeping them better informed.

How Managements Keep in Touch With Soldiers

Veteran-conscious managements have long recognized the wisdom of keeping in close touch with their servicemen. Westinghouse, for example, has had a comprehensive program which included issuance of a handy booklet, "To Employees Entering Service." The Allis-Chalmers Manufacturing Company sends regular letters from Walter Geist, president, to servicemen, apprising them of post-war prospects and urging them to return.

Hosts of others—Republic Steel, International Harvester, Eastman Kodak, Acme Steel, to name but a few—have done thorough jobs with exceptional success. International Harvester, indeed, sends representatives to visit servicemen in hospitals.

Some companies have regularly sent Christmas bonus or vacation checks or both to servicemen. A similar example is provided by Ilg Electric of Chicago, which has announced increased participation for veterans in its long-established profit-sharing plan. Here and there a company has even made up the difference between every employee's peacetime earnings and his service pay.

A minimum program should certainly consist of sending the house magazine regularly, plus a letter giving reassurance on reinstatement policy,

plus an occasional gift remembrance, and *something* in the nature of personal recognition. Anything above that is all to the good. The men in the foxholes do worry about jobs, naturally. And they like to get more information about the folks at home, the company, and the post-war economic outlook.

Policies Vary But All Agree on Principle

As for making the veteran welcome on his return, policies vary widely. Lever Brothers of Canada, for example, has set up a welcome and placement committee comprising a director or senior executive, the personnel manager, and an employee of some standing who has been in the service. The returning veteran is received in a comfortably furnished, unoffice-like room by the committee, which has previously studied his peacetime employment record, his service record, and something of his family circumstances. They are then in a position to discuss his new job thoroughly, for Lever, emphasizing placement, believes that 40 percent of most employees were "square pegs in round holes" before the war.*

Now this policy, oddly enough, is rather controversial. Some managements contend that it goes too far in giving the veteran a feeling of belonging to a "special" group, whereas, they say, the whole object of a good program is to reintegrate him on an equal footing with civilians.

No matter. All agree on the *principle* of welcoming veterans, the first reason for which is sound business wisdom. If a veteran with reinstatement rights wanders into a personnel office, talks to an inexperienced interviewer without identifying himself, asks "How about a job?", is turned down, and goes away jobless, he may be leaving the basis for a reinstatement action against his employers.

But the moral reasons are far better than that, of course. The veteran has been away a long time. He's proud and shy, a little uncertain of his welcome, eager for recognition and acceptance amid the "old gang" and the home scenes (which he has probably been idealizing in his dreams overseas). A careless or callous reception can turn all that to bitterness in a moment—and set up a lasting reaction against management.

What he needs is to be greeted by somebody in authority who knows what his ribbons, combat stars, wound stripes, and citations mean; understands what he has been through; wants to see him happily settled in a job; and takes an interest thereafter in seeing that he finds his way smoothly into the old grooves.

Case for Retaining Veterans' Counselors

Such a man is the veterans' counselor. Whatever his title, he is a veteran himself, either of this war or the last, and a first-rate human being with warm qualities of leadership. To

* An interesting additional Lever policy: "If a man who was in our employ prior to the outbreak of the war, on being discharged from the services because of disability or disease, is reemployed at a job rate lower than that at which he was working at the date of enlistment, he will receive from us as an allowance the difference, if any, between the standard rate of pay of the job in which he is reemployed, plus his disability pension, and then the standard rate of pay attaching to that at which he worked on the date of his enlistment."

A VETERAN RETURNS TO HIS JOB AT RCA

The key principles of a good veterans' reemployment program are exemplified in the Camden, N. J., plants of the RCA Victor Division of Radio Corporation of America. At the right is Frank Lamanna, long-time RCA employee who served an overseas hitch with the Navy "Seabees." A warm welcome, a thorough physical and vocational check-up, contact with a counselor, and a follow-through after placement are the essential steps in RCA's program. Lamanna is a clean-cut reinstatement case. He heard frequently from his employers while he was away and says, "I never had any doubts about getting my old job back, even though some of the other fellows overseas were worried."

First to greet the veteran is Martin Costello, a veteran himself. This initial friendly chat is designed to bring out any problems that may have arisen during the veteran's absence. New skills are also noted. Veteran Frank Lamanna has some, but he wants his former job

the veteran he is management and he is a friend.

To the counselor, the proper reception and placement of the veteran is a matter of deep, personal concern. No matter how complete the plant's staff services may be—personnel, medical, training—he has a real function and a vital one as a sort of "lubricating" force.

The counselor keeps the veterans' records. He sees veterans who have personal problems to discuss. When a disciplinary question involving veterans comes up, he talks to the foreman (in some plants it is mandatory that foremen clear such cases with the counselor before passing them on to industrial relations). Occasionally he may even intervene with a shop steward to keep a veteran out of grievance procedure.

Psychological Side of Counseling

In short, the counselor is the veteran's advocate to management and the management's advocate to the veteran. Because he has been through a war himself, he knows—and can explain to supervisors and fellow employees—the psychology of the "decompression period" (see page 92). And to the veteran he lends an all-important "listening ear," a safety valve for emotional strain.

Also because he has been through a war himself, the counselor can spot a "gold brick" or a born trouble-maker at a glance. He isn't there to coddle anybody, for that's not the Army's way, nor does he believe in privileged characters.

In the anteroom of a New England employment office not long ago, a young veteran was ranting profanely and loudly at what he called the ingratitude shown him in view of his sacrifice and his wounds. The veterans' counselor, a slight, mild-mannered veteran of the First World War, listened quietly. Then he drew out a $10 bill.

"My friend," he said, "I'll bet you this ten-spot that I spent more time standing at attention than you spent in the Army. What's more, I'll match you wound for wound and have 10 more than you have."

The other subsided.

"I hated to do a spectacular thing like that," the counselor said later. "But I was pretty sure he was bluffing. They say, you know, that the wheel that squeaks the loudest gets the most grease. If a chap like that demands, and gets, a lot of 'gratitude,' then some man who really did sacrifice a lot may be neglected. We believe those who gave the most deserve the best."

All in all, it is hard to see how the function of a veterans' counselor can be fulfilled in any other way. Admittedly, only large plants can hope to retain qualified counselors now. But eventually all plants, large and small, will have men coming back to the executive posts they held before the war. If they have the right personal qualities, they can fulfill the counseling function no matter what their title or their other responsibilities.

Some Notes From Counselors' Records

"Here's a real problem, says C. A. Adams, veteran coordinator of Eastern Aircraft Division, General Motors, Linden, N. J., and a veteran of the First World War. "Often a youngster comes back to us wide-eyed at all he

Lamanna's old boss welcomes him back while fellow-employees gather to hear of his experiences in the Mediterranean theater. They also talk over changes in the job routine. Following a complete physical check-up, the former Seabee is ready to come back to work

Here he is, back on the job. In a month or so, a follow-up man will check. Where problems arise, new training is arranged

has heard about the big money—$50 and $55 a week—that the war plants are paying nowdays.

"Sure enough, it turns out to be true. He's started at $1.09 an hour, let's say. He gets 52 hours pay for 48 hours' work and it looks good to him. So he goes and gets his wife, who's been living with relatives probably. Then they find an apartment at—possibly—$55 a month. This seems plausible, since it's only about a quarter of the monthly pay. Then they buy furniture on time, at high prices too, but still it looks as though they ought to be able to carry it on $55 a week.

"Then comes the first paycheck—and disillusionment. It isn't $55 at all, what with withholding tax, Social Security, War Bonds, and whatnot. And before you know it, your young man is in a financial jam. Well, we don't know the solution, but we've found this answer: We're very careful to warn men against making too many commitments—and to remind them also that the debt moratorium is off."

Caution Sometimes Urged on Veterans' Plans

At the New Departure Division of General Motors, Bristol, Conn., Maj. Ray Hagedorn, veterans' counselor home from action in the South Pacific, finds that it's often necessary to flag down veterans with high hopes for going into business or taking up educational plans that are not as rosy as they seem.

Take A, who has learned a lot about radio and wants to start his own business. He isn't aware of all the difficulties about priorities, materials, and so forth. As counselor, Major Hagedorn can give him a more realistic picture of his prospects and suggest that he settle down in the plant a while until he gets accustomed to things as they are. Thus he may save A from failure, disillusionment, and the loss of a sense of security.

Then there's B, who reads of the G.I. home loan provisions with a little too much enthusiasm and puts a deposit on a house without stopping to find out whether the deal will qualify or not. It does not. So the counselor (1) recovers the deposit from the real estate man; (2) shows B how to go about house-buying properly; (3) finally sees him happily located.

As for placement, there's C, who contracted a tropical foot trouble of a fungus nature at Guadalcanal. He is given a sitting job—which is good placement. But it is a warm room and the ailment, by no means healed, causes a strong odor. C's fellow employees don't want to hurt his feelings by complaining. The shop committeeman tells the counselor about it. The counselor sees the foreman, learns C is a good worker, well liked. Then comes the diplomatic job for the counselor. He strikes up a conversation with C, persuades him to visit the plant physician, finds the ailment much aggravated, arranges for C to spend a little time at a nearby Veterans Administration Hospital. Soon the trouble is cleared up, C is back at work, and everybody's happy about the problem's smooth solution.

D has a leg wound suffered in the South Pacific. The plant physician is reluctant to let him return to his old job which involves much standing. D insists, saying "I won't let it lick me." The counselor likes his spirit, lets him try it. D makes good and is proud and happy. (The counselor keeps close watch on him, just the same, but D doesn't know it.)

E was hospitalized after discharge, some time ago, and lost his place on the seniority rolls because he could not apply for reinstatement within the (then) 40-day period. The counselor talks that over with supervision and the union representatives, and they all agree to stretch a point.

F makes a big point of being a veteran and boasts about military exploits which the records fail to confirm. He is given an excellent job but complains constantly. The counselor and (in this case) the plant psychiatrist, talk over his case with supervision. Together they decide he's not really worth laboring over. So when F kicks up a row and quits, no effort is made to detain him.

G on the other hand (this from the case records of Dr. Gordon A. Eadie at the Eastern Aircraft plant, Linden, N. J.) was a genuine case of severe combat fatigue reaction with neurosis. In action in Italy as a Second Lieutenant, he lost his memory for a time. But he is a fighter, and he responds readily to psychiatric and vocational guidance. An outdoor job with some freedom of motion is indicated. G gladly takes a job in plant protection. Recovering rapidly, he is alert and happy now—an increasingly well-knit personality who enjoys writing plays and poems in his spare time.

These are random examples, typical of scores and hundreds, which emphasize the importance of individual care of veterans in placement and handling, a far different thing from "coddling." The good counselor is there to serve the veteran—but when the veteran is wrong, he will set him straight. And when the foreman is right, he will fight for the foreman.

Training Supervision in Handling Veterans

There are two schools of thought concerning supervisory training on veteran questions. One of the nation's foremost exponents of foreman training believes it a mistake to set the veteran apart by such a distinction.

Not long ago, however, a FACTORY editor "sat in" on a foreman training session at New Departure and derived a strong sense of its value. Conducted by Major Hagedorn, in friendly, informal fashion, the course consists of four sessions at which questions and discussion are encouraged.

The course is based on New Departure's excellent conference leaders' manual, "Returning Servicemen," prepared by the training department. The manual includes these chapter headings: The New Situation Confronting the Foreman; The Employer's Legal Responsibility; Management's Moral Obligation; Government Regulations; New Departure Policy; The Personal Element; Supervising the Physically Handicapped; Supervising the Emotionally Unadjusted; Local Agencies and Facilities; State and National Agencies; New Departure Procedure for Reinstating Veterans.

Foremen, busy with production problems, had not had time to catch up on the veteran question. This course awakened them to the importance of the problem and revealed a real eagerness on their part to know more. The course has also been presented before local groups in Bristol, such as the American Legion, Exchange Club, Rotary Club, and Board of Education. Officials of the local union also requested a presentation in order to impart a uniform understanding of the problems and policies to shop committeemen. Copies of the handbook may be obtained through Robert T. Collins, director of industrial relations.

"Brass Tacks" on Handicaps

Is there a tendency to make too much work of the reemployment of handicapped veterans? As the early returns come in, it appears that there may be a danger in over-complicating the question.

There is, first, the supposition that elaborate machinery is required. Accepting this belief, some companies have set up elaborate procedures. Awed by it, others have done nothing at all.

Second, there is the inclination to assume that all wounded men will be handicapped men—armless, legless, blind, or deaf. But, as FACTORY pointed out in the first of these articles, medical treatment has advanced impressively in this war. Of the Army's first 100,000 wounded, 50 percent were returned to active service and about 1 percent suffered amputations.

What does that mean to the average plant? Well, the ratio of wounded to killed among U. S. casualties is about 3 to 1. If a plant has 33 gold stars in its service flag, it can assume (until there is some more definite way of knowing) that about 100 of its men have been wounded, one of whom has probably suffered an amputation. That's a pretty good-sized plant, by the way. Thirty-three deaths would imply about 1500 blue service stars (men in service) and a total employment of about 7500.

The placement of a single amputation case, or 10 cases, or even 100, in a plant of anything like that size would hardly constitute an insuperable problem. There are several plants which in peacetime have been almost entirely staffed by handicapped persons, and others that have long maintained entire departments on the same basis. For, truth to tell, civilian accidents and illness take a devastating toll. Some 200,000 deaths and over 5,000,000 injuries resulted from automobile accidents alone in the five years from 1935 through 1939.

He's deaf, dumb, and blind—but he's working. While this man is not a veteran, his case gives spectacular proof to the contention that "where there's a will, there's a way" to find employment for almost any handicapped person. His employer is Walter Kidde & Company, Bloomfield, N. J. He works full time, has a highly developed sense of touch, and learns quickly. His foreman spells out instructions

When manpower shortages became acute in the current war, many companies began employing handicapped persons for the first time. There was no time for extensive preparation, but by applying a few simple rules industry discovered that it could—and did—take on several hundred thousand handicapped persons between 1942 and 1945.

Not long ago, George T. Trundle, Cleveland industrial engineer, observed that employers were too prone to look at a handicapped man and say, "What in the world can he do?"—implying that if the man did not meet an arbitrary physical standard he was wholly useless.

"But," says Trundle, "if the employer asks himself the question, 'What *can't* he do?' he will find in most cases that there are a variety of jobs in his plant that that disabled veteran can perform, and placement

WELL WORTH LOOKING UP

Getting Disabled Veterans Ready for Factory Jobs
SEPTEMBER, 1944—p. 113

How Peoria Finds Jobs for Disabled Veterans
JUNE, 1944—p. 129

Ready for Disabled Veterans
MARCH, 1944—p. 100

Rehabilitation of Veterans Must Begin Now
FEBRUARY, 1944—p. 82

How Handicapped Workers Fill Manpower Needs
MARCH, 1943—p. 108

We Hire Men and Women Who Are Handicapped
JANUARY, 1943—p. 116

becomes a matter of using good common sense in the light of the disability and the job available."

In a survey of jobs currently being held by men having some one of the nine most prominent types of handicap, Trundle found precious few jobs that such men could not do—and the survey covered fourteen different companies. Trundle urges a program of job analysis for each plant, so that when a disabled veteran comes in the employer can glance at a list of jobs open in relation to the various types of disability.

This is the "physical demands" type of analysis—not too difficult to make—which many companies have undertaken and many more are contemplating. For example, the steel industry was never considered a particularly suitable scene of "rehabilitation," yet U. S. Steel and other steelmakers have surveyed their plants and found countless job opportunities for the handicapped and disabled.

What, then, it is often asked, of the small employer? Well, it begins to appear that he can place the relative handful of handicapped veterans who may return to him without recourse to extensive medical and placement machinery. For his assistance, the Veterans Employment Service of the War Manpower Commission is arranging a series of regional conferences, concerning which further information can be obtained from veterans' representatives in local WMC offices.

The real value of "physical demands" analysis of jobs, for all employers, will lie less in the placement of the handicapped than in that of the partially disabled. "Handicap" and "disability" should be considered as two quite different things. Analysis should therefore include not only the handicaps (amputations, arm or leg; deafness or blindness, partial or total; and serious speech impediments) but also the common disabilities (hernia, flat feet, sinus, asthma, back injuries, stomach ulcers, kidney conditions, arthritis, dislocated knees, heart conditions, and other things usually considered civilian in character) which will, among veterans, outnumber the standard "handicaps" 10 to 1.

Plant physicians are finding that these less spectacular ailments are the usual disabilities even of men who have seen combat action overseas. Wounds (and doctors says that war wounds resemble civilian accident wounds in character, differing only in multiplicity) will heal, but hernias can be aggravated and kidneys can be "shot" by life in the war zones. Employers should guard against placements that will aggravate such conditions. In some states, indeed, compensation laws are being relaxed to give employers freer play in the placement of veterans. This is well, for 20-odd percent of all veterans will be allowed some sort of disability pension claim, mostly partial, on discharge.

The Facts About Psycho-Neurosis

As a result of the war, industry is being asked to understand a number of strange things. One of them is "psycho-neurosis." The topic has been, and will be, kicked around a lot, and FACTORY is going to have a try at it, too, because it may have a good deal of unsuspected importance to industrial employers.

A word emphasized by the war, "psycho-neurosis" is usually thought of in connection with veterans. Actually it applies (so far as the employer is concerned) to a very limited number of veterans and a high proportion of civilians.

At a recent annual meeting of the National Association of Manufacturers, Dr. C. Charles Burlingame called attention to the fact that war workers, whose "whole scheme of life was upsetting and unstabilizing," will produce "a higher percentage of unstable, neurotic individuals than discharges from the armed forces. . . ."

While pondering this, employers will recall that more neurotics were screened out of the armed services than ever got into them. We shall now beg two questions: (1) Are civilian psycho-neurotics an employment problem? (2) Is their rehabilitation a concern of the employer? Without attempting to answer them, it can be agreed that here is something in the nature of a practical problem which industry ought to look into.

Taking the Mystery Out of Psychiatry

No disease ever appears in the mortality tables until it is given a name. After that, it causes a lot of deaths. Until appendicitis was discovered, for example, people just had bellyaches. Yet the fact remains that the dangers of appendicitis were reduced—actually if not statistically—when doctors learned to diagnose and treat it.

Psychiatry, the modern mother of "psycho-neurosis" and other terms, appears at the moment to be one of mankind's more dubious boons. A specialty which baffles its own practitioners so readily, may leave the layman pardonably puzzled. Yet industry will profit from an attempt to understand this strange science which has been so heavily emphasized, and in one way so absurdly exaggerated, by the war.

The first lesson comes from a frank and forthright psychiatrist, Dr. George H. Preston, Maryland Commissioner of Mental Hygiene. Says he:

"Psychiatry suffers from words. Look at some of them: 'schizophrenia,' 'hypochondriacal,' 'hebephrenia,' 'masochism,' 'pathergsias,' 'psychosis,' 'psycho-neurotic,' 'manic-depressive,' 'dissociative' . . ."

And he names some more, adding:

"Once you have mastered them, you can lead them around as pets. They serve much the same purpose as vicious-looking bulldogs. They prevent the intrusion of strangers into your domain and give you a feeling"—here the speaker is unexpectedly bitten by one of his own dogs—"of security."

Admitting, moreover, that these words are but dimly understood by the initiated and completely mystifying to the outsider, he concludes:

"It is mystery which has done psychiatry harm in its contact with the general public."

For the employer's purposes, such

words as "schizophrenic" and "masochistic" may safely be left to stew in their own mystery. There appear to be only three terms on which the layman needs to get a strong grip:

1. "Psycho-neurotic," which broadly covers a host of broodings, fears, and maladjustments rendering the individual jittery and unstable, but rarely resulting in hallucinations, violence, or the other manifestations of outright madness.

2. "Psychotic," which broadly covers all types of positive, serious, deep-seated mental derangement. (Psycho-neurotics are numerous, psychotics are few. The difference between them is as great as the difference between measles and pneumonia.)

3. "Combat fatigue," which covers broadly every type of mental upset, ranging from mild psycho-neurosis to psychosis of the most distressing sort, that originates purely in the stress of battle. It is this war's term for the "shell shock" of the First World War.

The public recollection of 1918 shell shock, indeed has done much to cause needless apprehension over the psychiatric problems of this war. The incidence of shell shock was much higher then than now; the results were often permanent and pitiable; and the means of prevention and cure were much more limited.

Raising an army is an egg-candling process, after all. And we learn something from each war. Had we known anything of psychiatry in the past, the Union Army would not have suffered 600,000 desertions in the Civil War, nor would shell shock have taken such a toll of 1918's AEF.

Civilian "PN's" Will Outnumber Military

In this war, we acknowledged for the first time the necessity for testing men for mental, as well as physical, fitness to face the rigors and dangers of military life. So we candled out our psycho-neurotics by the hundreds of thousands at the induction centers and the training camps, and put them back in the civilian basket. Consequently—and this is immensely to the credit of psychiatry—some hundreds of thousands of potential shell shock cases sat this war out with great benefit to the armed services, the nation, and themselves.

At the induction centers, about one man in ten was rejected for military service because of "obvious nervous symptoms." The rejection was based on military standards, of course. Yet it is probable that many of these men are not any too well-balanced by any standards.

Since then over 1,500,000 men have

QUESTIONS THAT REVEAL PSYCHO-NEUROTIC TENDENCIES

1. How old were you when you could walk?
2. Do you have frequent headaches?
3. Are you upset by lightning or thunder?
4. Did you ever have a concussion? Ever knocked out?
5. Are you uncomfortable in a closed room?
6. Are you afraid when in high places?
7. Are you uncomfortable when in crowds?
8. Have you walked in your sleep since childhood?
9. Have you had nightmares since childhood?
10. Have you ever had fainting attacks, dizzy spells, or blackouts?
11. How old were you when you stopped biting your nails?
12. Are you ever afraid of the dark?
13. Did you ever have a nervous breakdown?
14. How old were you when you stopped wetting the bed?
15. Has any relative ever had high blood pressure?
16. Has any relative ever had a nervous breakdown?
17. Did any relative ever have cancer?

The answers to these questions will tell the plant physician a lot about the physical and mental condition, personality—and desirability—of any prospective employee, civilian or veteran. Questions (1), (11), and (14) reveal development, whether retarded or not. A "yes" to (2) suggests, physically, migraine and the possible danger of a brain tumor; mentally, it may (in combination with other points) suggest neurosis. Questions (3), (5), (6), (7), (8), (9), (12), (13), and 16), reveal specific neurotic characteristics. Anyone who answers more than three or four of this group in the affirmative is pretty likely to have psycho-neurotic tendencies. (10) is another warning sign which tells the physician to watch out for anything from simple fainting spells of a neurotic character to epilepsy. (15) is associated with nervous tension in the family. (17) is asked not because of the information it yields but because of what the examiner learns from the nervous reaction to the question itself.

These tests, devised by Dr. Gordon Eadie, are now in use experimentally at Eastern Aircraft Division of General Motors, Linden, N. J. Other observations by the interviewers include: Stammering or stuttering; nail biting; blushing or very pale; excessive sweating; noticeable tremor of hands; attitude (cooperative or otherwise); tics or mannerisms; appearance, and intelligence. These tests are not to be regarded as complete tools nor their results as final, and they may be changed after further experiment.

been discharged from the service, of whom roughly 30 percent were labeled "psycho-neurotic" after being subjected to further candling in the training camps. Does this mean that one-third of *all* servicemen are "PN's"? Quite the contrary. It means that the armed services have got rid of most of their *inherent* psycho-neurotics. The men remaining in service after this screening are overwhelmingly better balanced, more adaptable, and of tougher mental fiber than any equal number of civilians.

There Is an "End Point" of Nerves for All

Down to date nearly all the "PN" dischargees have come from the training camps, and only a handful have been overseas, much less seen action. Hereafter, the total number of "PN" discharges will probably dwindle, but the proportion of overseas cases among them will probably increase.

How numerous, then, how serious, and how much of a problem are these —the genuine battle fatigue cases— likely to be?

Well, to inquire a bit into the nature of combat fatigue, take first the assertion of the military psychiatrists that every man has an "end point" past which he is too disturbed nervously and emotionally to carry on. In civilian life, this frequently takes the form of a nervous breakdown. In military life, the point at which a man can no longer fulfill his military assignment is the one at which he gets the "PN" label.

Now a garbage collector with an I.Q. of 66 may hit his military "end point" 48 hours after his induction into the strange and terrifying atmosphere of a training camp. Treatment consists of sending him promptly back to civilian life where his adjustment to the routine collection of garbage is not in the least impaired.

A Rhodes scholar, on the other hand, may reach *his* "end point" after 48 combat missions over the Siegfried Line. Treatment in his case consists of rest, psychiatric care, and readjustment. Marvelous methods have been developed in this war. Severe combat fatigue, the equivalent of a bad case of shell shock by 1918 standards, no longer spells disaster.

For example: In the Air Force, 92 percent of all cases of severe combat fatigue are returned to active duty— 65 percent to combat flying, in fact; 15 percent to some other form of flying; and 12 percent to ground duty; while only 8 percent are discharged.

"And 90 percent of those 8 will know how to get along in civilian life," says Col. Howard Rusk of the office of the Air Surgeon General.

As for the ground forces, Lt. Col. Malcolm J. Farrell of the Surgeon General's office recently assured a meeting of the American Management Association that:

"In combat zones it is found that when neuro-psychiatric casualties are properly recognized and treated at forward areas, up to 80 percent can be returned to combat duty successfully."

As for psychotics, the industrial employer is far less likely to encounter them among veterans than among civilians. They constitute about 0.5 percent of the civilian population and much less than that of the military population. Civilian psychotics are frequently overlooked until they identify themselves as Napoleon or run amok. Military psychotics are readily diagnosed, hospitalized, and *detained until cured.*

Overseas Men Will Need "Decompression Period"

Having deflated as thoroughly as possible the notion that veterans as a class constitute a "mental problem," it is possible to discuss rationally the fact that veterans do have nerves. Beyond question they face difficulties in readjustment—as anyone would who has been away a long while, war or no war.

Army psychiatrists say that any man who has served overseas—in the war zones—can't help being keyed up. Consider fear as one of the true ingredients of courage. The reaction from fear is a discharge of the adrenalin secretion, a sudden alertness, lightness, calmness—and an accession of fighting strength. This is something a civilian may experience once a year or once in a lifetime. It is something the fighting man experiences 10 or 12 times a day. As a result he comes back "supercharged," so to speak.

In the words of one wise Army doctor, every such man needs a "decompression period" in which to accustom himself to the slower, less hazardous tempo of civilian life. It may last only 90 days or so, but during that period he will be restless, jumpy, constantly—and often unexpectedly—on the go. He may hail an old friend one minute, and rush away the next. He may walk out inexplicably in the middle of a show or a party. In conversation, he changes the subject frequently. He is full of half-formed plans which he may launch and abandon impetuously. He is aggressive, pugnacious, quick on the trigger.

The "decompression" theory is a strong argument for not rushing the veteran into a job. More and more employers, when they note such symptoms of nervousness, are urging the returning serviceman to take his time about coming back and offering to hold the job open a little longer if necessary. It is also a strong argument for careful placement. As a rule—and this is as plain to a layman as it is to a doctor—a noisy place is not a good setting for a man with unsettled nerves. Yet he may be happy amid much noise *if the job is one he really likes.* And he may go to pieces sitting still in a quiet corner of the plant if what he really wants is a chance to move around a bit, stretch his legs, and talk to people.

It is also a strong argument for explaining the "decompression" situation carefully to foremen and fellow-workers. It is an argument also for the retention (by plants that can afford it) of staff psychiatrists (when and if available). For they can recognize the danger signals and recommend specific measures with a skill born of training. In essence, of course, the "treatment" is a simple, natural mixture of tact, decency, common sense, and forbearance on the part of all those with whom the veteran has contact.

It is, above all, the strongest possible argument for retaining veterans' counselors. For it is they who understand the veteran, first-hand, who pay extra attention to the placement, who explain the problem to supervision, and who, finally, lend the listening ear that is so much needed.

So much for the veteran's "psycho-neurosis." Does the civilian's emotional and mental life represent a problem for employers? That question may justly be raised on the ground that mentally healthy, well-adjusted people should, in general, make the most productive employees. But the further exploration of that question is not the business of this article.

Scale Models Make Plant Layout a Sure Thing

BYRON L. CLARK, Supervisor of Plant Layout, Consolidated Vultee Aircraft Corp., Nashville

Three-dimensional layouts make it possible for the industrial engineering department to plan methods changes with far greater assurance of success when actual installations are made in the shop

CHANGE-OVER FROM MANUFACTURE of Vengeance dive bombers to high-speed production of P-38 Lightnings at the Nashville Division of Consolidated Vultee Aircraft Corporation, was recently completed with scarcely a hitch. Today new ships are coming off Convair's final assembly line right on schedule, and manufacture is proceeding exactly as the industrial engineers envisioned it some months before.

Credit Third Dimension

At least some of the credit for this accomplishment must be attributed to the successful use of three-dimensional layouts and the building of a scale model of the entire plant. In the opinion of the division's industrial engineers, this new technique provides the following advantages:

1. *Makes planning more accurate.* If a proposed change can be accommodated by the three-dimensional layout, it will undoubtedly work in the shop; the layout man can proceed with that assurance. The "bugs" that hide in blueprints are quickly found and effectively removed.

2. *Provides necessary perspective.* It is far easier, when working with models, to determine the amount of space required for a given operation. Take the problem of opening up a department so that mobile handling equipment can be introduced. With three-dimensional layouts, clearances can be worked out to the proverbial gnat's eyebrow because projections on machinery and other obstacles are readily apparent.

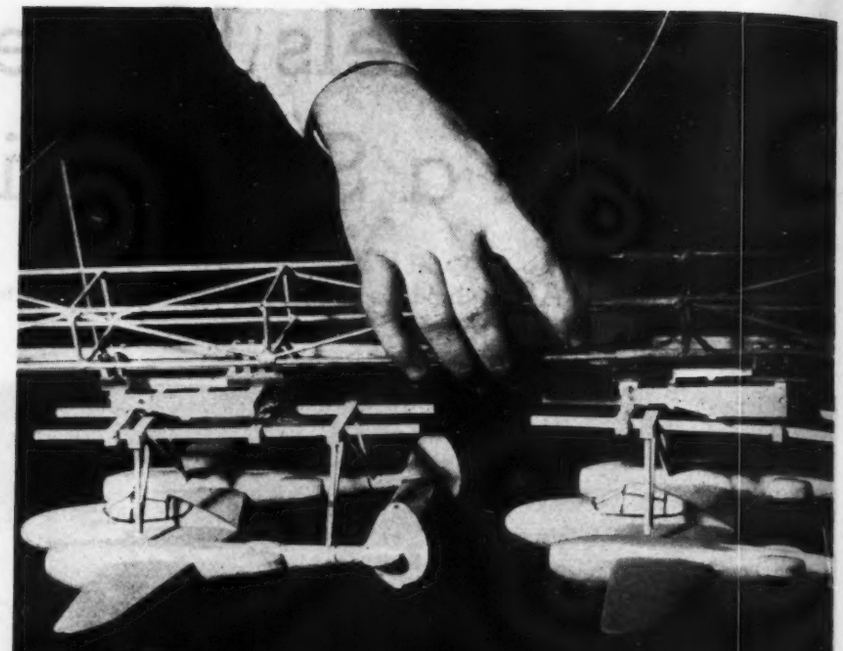
3. *Helps determine utilization.* Because of the ease with which three-dimensional layouts may be arranged and rearranged, maximum utilization of floor space, allowance of adequate working space for operators, and eco-

nomical flow of parts through processes are more easily secured than would be possible if layout blueprints or flat templet layouts were used.

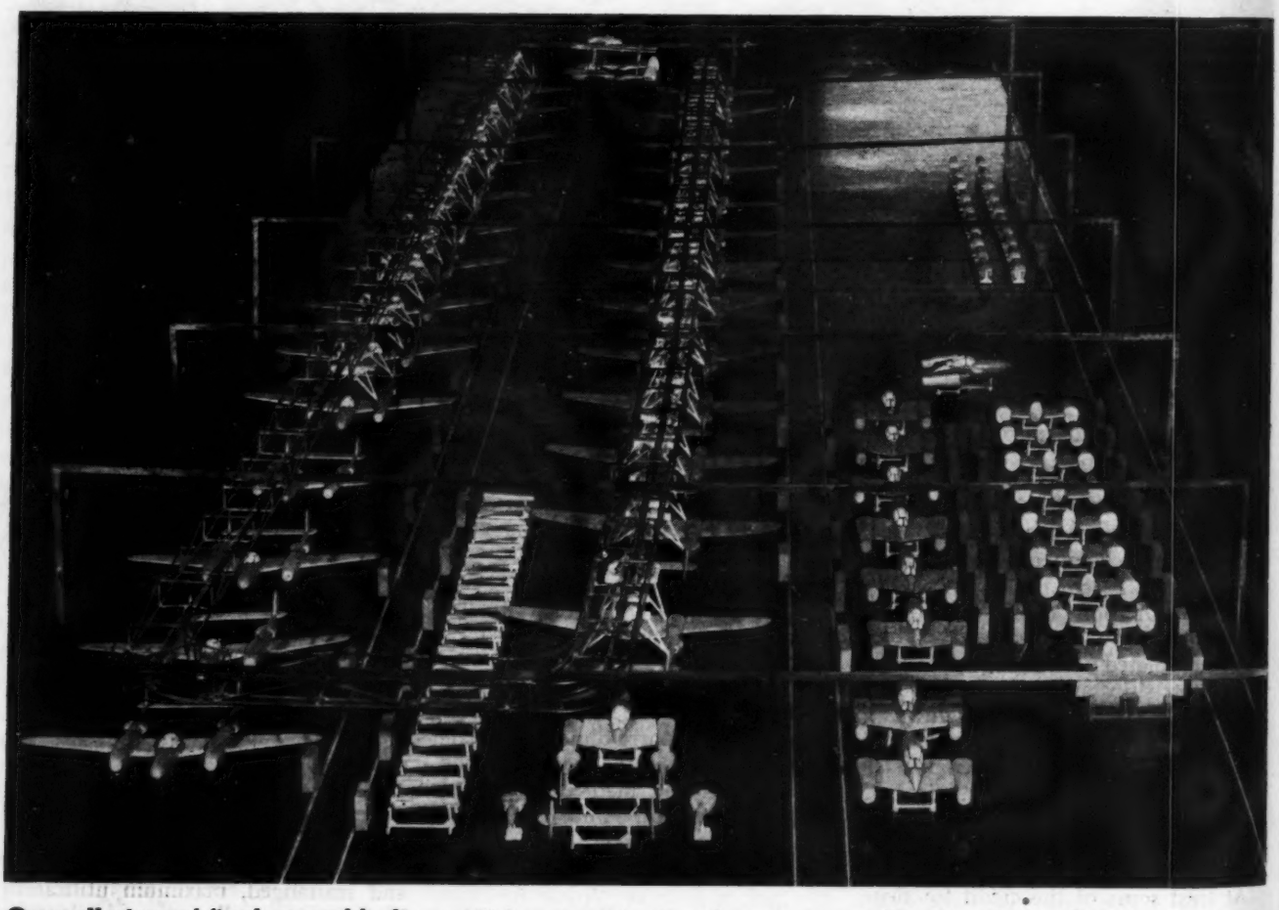
4. *Simplifies the task of setting up material accumulation areas.* Again the third dimension enables the industrial engineer to visualize, and thus helps him figure, the space required to facilitate the handling of materials within departments.

5. *Makes the entire organization "layout conscious."* Three-dimensional layouts are far easier to "sell" to supervisors—also to top management which, after all, must give the green light before the industrial engineering department can make a move in the shop. Since supervisors have learned that the shop is not just space to do a job in, but space to be utilized properly in order to do a better job, many excellent suggestions for improvements have been received.

The above are some of the advantages of three-dimensional layouts as appraised by the division's methods men after two years of experience with them. Use of the technique at the



Close-up of final assembly line shows how P-38's are suspended from the overhead conveyor. Scale model of line made it possible to switch from bomber to fighter production without a serious hitch



Over-all view of final assembly line as it is now set up. Thanks to three-dimensional layout, manufacture is now proceeding exactly as division engineers envisioned it some months ago

COLOR CODE

Red—electrically operated machines
Blue—machines operated by air
Purple—jigs and fixtures
White—portable storage racks
Green—stationary storage racks
Black—walls, columns, etc.
Yellow—airplane parts in process
Silver—completed airplanes
Orange—processing equipment
Gray—work stations

Nashville plant dates back to November, 1942, when a work simplification program was inaugurated. This marked the beginning of a determined attack on handling costs which, according to surveys made in the aircraft industry —where the emphasis has necessarily been, and still must be, on output at almost any cost—often constitute more than 50 cents of the production dollar.

One of the ways to lick this little problem—and it must be licked when the industry ultimately converts to peacetime production and gets back on the beam of lowest possible unit costs consistent with established quality standards—is to lay out the plant in a manner that insures the steady flow of materials with a minimum of effort and back-tracking.

There is no implication here that this cannot be done with two-dimensional layouts. It can. Many hundreds of plants have done it and are still doing it. Drawings obviously can be changed. Templets obviously can be moved about when industrial engineers get to experimenting with existing factory methods. And they can be moved just as easily as miniature machines can. The point is, once they are moved and the layout assumes final shape, the all-important third dimension must be added—and it must be added *in the mind's eye.*

In other words, the layout man has to take something with only two dimensions and translate that something into something quite different that has three dimensions. It *can,* in short, be done. But it *cannot* be done as readily or with the same assurance of ultimate success.

Getting down to some of the details that may be of interest to those about to try three-dimensional layouts, it may be said that Convair's are built to a quarter-inch scale and almost entirely of wood. Reproductions of machinery and equipment are accurate enough so that the various types may be recognized at a glance. For further identification, a color code is used.

Overhead conveyors are unpainted because they are up out of the way and so theoretically out of sight. Fences for cribs are cut from closed-meshed "chicken wire."

The base is insulating board painted black—one coat of enamel and a finish coat of lacquer to give a good glossy effect. Aisle boundaries were originally painted white. For obvious reasons, wood strips painted white are now being used. They can be easily tacked down and as easily pulled up and changed.

The first models were made by a girl who was working in one of the factory departments. Her hobby was making toys, so she was transferred to the industrial engineering department. She kept at it for five months and in that time completed two departments. Then in June, 1943, through the State Department of Education's vocational rehabilitation division, the present incumbent was hired. A victim of infantile paralysis, he was discovered working in a wood novelty shop at a summer resort.

P-38's in Miniature

Since coming to Nashville he has built hundreds of models to scale. His latest project was the building of 29 scale models of the P-38 from balsa wood. Hung on the model of the final assembly line they were instrumental in helping the company's methods men adapt existing conveyor equipment to handling the Lockheed fighter plane which has two engines to the A-35's one, hence different lift points.

From the models the division's engineers learned that they could use the conveyor superstructure, track, stabilizers, and load bars "as was." All they had to do was to change the adapters used in holding the planes.

For models like the P-38's just mentioned, a good deal of skilled whittling is required. Much of the equipment and most of the machines are made up in several assemblies and glued together. Items like toteboxes, benches, and stock racks, which require no carving, are stripped out in the carpenter shop and cut to size. Overhead conveyors are made of welding rod hung on a tack-welded frame. In addition to carving tools, the model maker has a jigsaw, electric drill, and belt sander.

Interest in plant layout at the Nashville Division led to the development of a course which was tackled with so much enthusiasm by the first class that it lasted 60 hours instead of the 40 originally planned. Members of this class were industrial engineers, methods analysts, production control people, etc. The next class will be made up of factory foremen who have been clamoring for a shot at it. Classes run two hours, meet three times a week on company time.

Some models require skilled whittling. Items that need no carving are stripped out in the carpenter shop and cut to size. In addition to carving tools, model maker has jigsaw, power drill, belt sander

Figuring Operation Cycles to Reduce Idle Time

A. B. WILSON, Superintendent of Standards, Cadillac Motor Car Division, General Motors Corporation, Detroit

ONE OF THE PROBLEMS standards men have to face in straight line sequential manufacturing is to balance the cycle times of operations to reduce idle machine or man time to a minimum. If this is done effectively, machine investment will be reduced and the time of the working force will be most effectively utilized.

To illustrate how this may be accomplished, the activities of one operator in the middle of a camshaft line will be used to show that correct cycling eliminated 0.58 minute of idle time in 3.82 minutes, or 15 percent of direct labor cost. In all, some 21 operations are required in this line; and in the old or original cycle plan this operator performed three operations—shave, burr and polish, and lap—with idle time because of inadequate balance. In the new plan, one operation, burr and polish, was taken away; and two were added, mill threads and file keyway, with no idle time.

Two Stages

Although effort is made to plan all progressive work right the first time, this procedure occasionally takes place in two stages. The first stage may consist of the preliminary cycling of a new part, which may hold for 30 to 60 days depending upon the amount of work ahead of the standards department. The second stage is that in which a permanent plan of cycling is devised, even though it may take some rearrangement, after the new part is in operation.

In the first stage, a new part starts from the layout board. The standards department, in cooperation with the foreman, cycles the operation on the basis of the estimated handling time and running time of the machine. In this stage one operator may be assigned to one machine, while another operator may be assigned to two machines, and so on; but this is a calculated approximation made to get the part and line into operation quickly. The proper balance may not be attained, nor may the sequence of steps performed by the operator be such as to give him a rhythmical method of operation. The

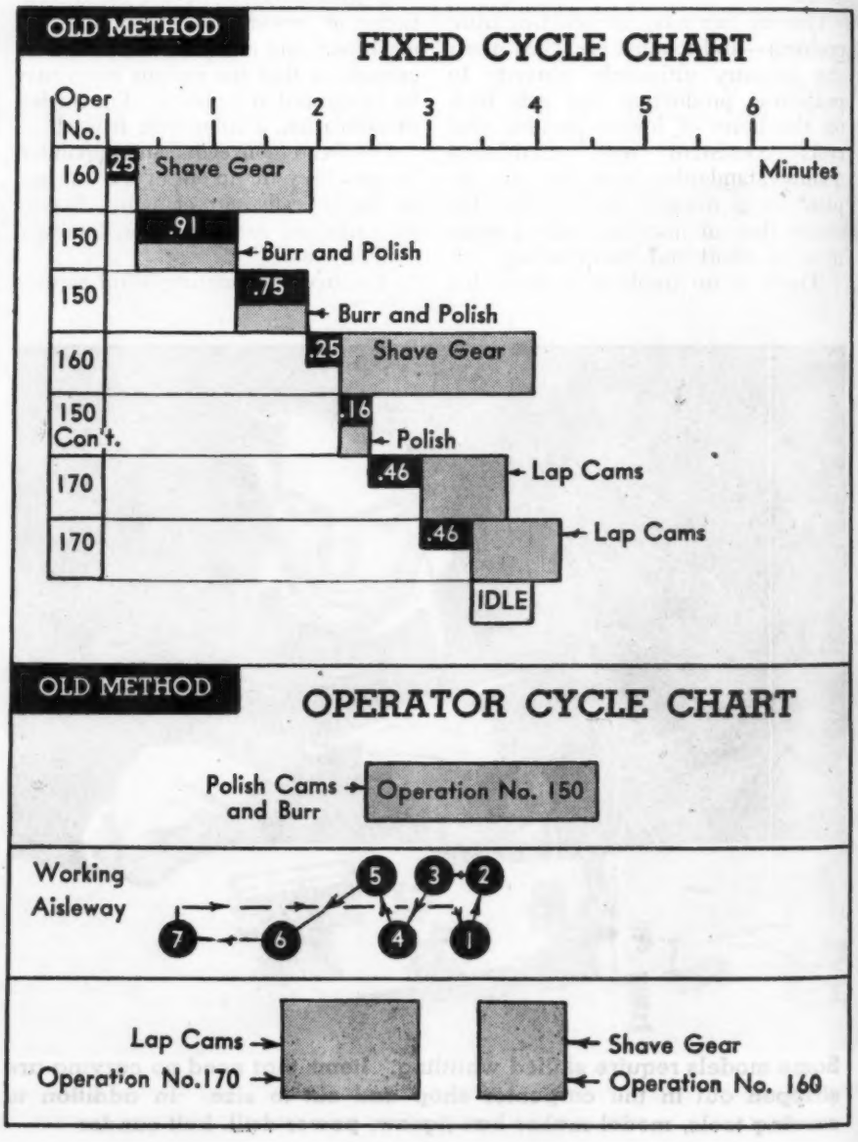


Figure 1. Rectangular "time templets" for machine operations (shaded areas) are positioned on time charts in conjunction with spaces for manpower time required (black areas) to show the sequence of operations and how well or poorly they balance for operating economy. In this case an idle period of 0.58 minute is shown, together with the lack of cycle balance which is its cause. Lower diagram illustrates to operator how the sequence wastes steps and destroys rhythm

possibility of having a good cycle for the worker at the outset is better when the time available for planning is longer.

Too Much Idle Time

In Figure 1 is shown how this preliminary cycling resulted in 0.58 minute of idle time in each 3.82 minutes of operating time. The time study man studies every operation in the line and obtains element times for handling, machining, and walking from one machine or bench to another. This is entered on a consolidated sheet covering the activities of each operator. For example, the basic elements for operations 150, 160, and 170—burr and polish, shave and lap respectively—are selected (not necessarily with regard to sequence) from the observation sheet (see Table I).

The italicized figures are, on the time study sheet, noted in red pencil which indicates idle time. It will be observed that only 0.29 minutes of the gear shaving time, instead of the full time of 1.66 is allowed or counted as a part of the task time; and none of the cam lapping time of 0.78 minute. If the allowed time for operations 170 and 150 are added and this total subtracted from the key operation of gear shaving, the difference is 0.29 minute (1.66 – 1.37), which must be allowed as idle time for the operator. Since two pieces are carried at a time through these operations, the 0.58 minute of idle time results (2 × 0.29) in each 3.82 minutes.

It is a great deal easier to secure a balance, and to demonstrate the plan to the worker, if a graph is made. Figure 1 is such a sketch of the elements noted above and how they fit together. Two parts are taken from the gear shaver, operation 160, and carried to burr and polish, operation 150. Each part requires 0.91 minute for completion; this may be checked with the element times above by adding all allowed time on operation 150. However, the machining time of the shaving operation is 1.66. Since to burr one piece takes 0.91 minute, the second piece is not finished, for only 0.75 minute may be devoted to it (1.66 – 0.91) before the operator has to walk back to operation 160. After the completed part is removed and a new part inserted (0.25 minute), the operator walks back to operation 150 and finishes the second piece which he had begun during the fist cycle of operation 160. This, as noted, takes 0.16 minute. To service the lapping machine, removing and inserting a new piece, requires 0.46 minute for each piece. Two cycles of the gear shaving operation, the key job, consume 3.82 minutes, but supplementary operations fail to balance out the time by the 0.58 minute stated at the bottom of the chart.

The lost time shows up at the end of the second half of the cycle when, as shown in Figure 1, the 0.16 for polishing, and the two periods of 0.46 each for operator's time on the lapping machine, total 1.08—leaving the operator idle for 0.58 minute while the gear shaver is completing its second shaving operation.

How this sequence causes excessive walking and how the split in the burr and polish operation destroys any rhythm in the operation is indicated in the operator cycle chart of Figure 1.

Templets for Time Used

In practice, the time cycle charts are drawn on cross-sectioned paper with ten lines per inch. The scale at the top is in minutes. Templets of standard width are made with the length proportioned to the length of the time scale at the top. For example, if 1 inch of distance on the time scale represents 1 minute, a templet for a machine with a cycle time of 1 minute would be 1 inch in length. These templets, constructed from the element time studies, are moved about on the

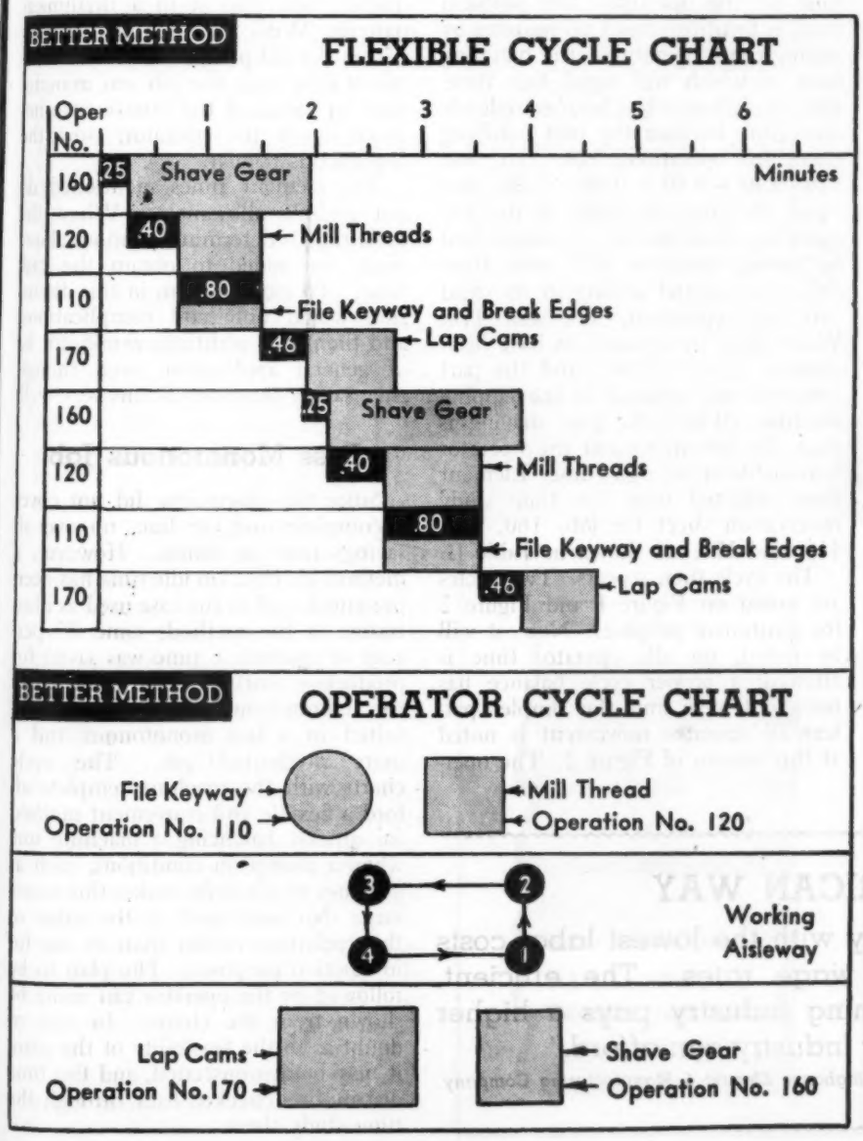


Figure 2. By substituting "time templets" for different operations the process of discovering a balanced cycle is simplified. In this instance, a new combination of machines reduced idle time to zero, restored rhythm to the job, and made it more pleasant and less fatiguing. Motion diagram reflects the new simplicity of the operator's procedure and was prepared to show him the new technique and its advantages for him

Table I

Operation No. 150	Average	Allowed
Walk to speed-lathe	0.07	0.07
Pick up part — position	0.08	0.08
File and polish	0.72	0.72
Remove pieces	0.04	0.04
Operation No. 160		
Walk to gear shaver	0.06	0.06
Remove part — position — start	0.19	0.19
Shave gear	*1.66*	*0.29*
Operation No. 170		
Walk to lapping machine	0.06	0.06
Remove part — position — start	0.40	0.40
Lap cams	*0.78*	•

Table II

Operation No. 160	Average	Allowed
Walk to gear shaver	0.06	0.06
Remove part — position — start	0.19	0.19
Shave gear	*1.66*	
Operation No. 120		
Walk to drill	0.06	0.06
Remove part — position — start	0.34	0.34
Mill threads	*0.82*	
Operation No. 110		
Walk to bench	0.07	0.07
Pick up part — position	0.08	0.08
File keyway and edges	0.61	0.61
Remove pieces	0.04	0.04
Operation No. 170		
Walk to lapping machine	0.06	0.06
Remove part — position — start	0.40	0.40
Lap cams	*0.78*	

chart until the best operation cycle is obtained, meaning when machine and man idle time is at a minimum. These templets are very helpful with a change in schedule, because then the lines have to be recycled; in fact, they are preserved for that purpose. The templet for the machine cycle would not change unless a better method of handling were devised, or an improved machine substituted.

Getting Better Balance

In the second cycling phase, that of improvement, the standards or time study man has the element times for the cycle chart of the present plan of operation, and the machine templets. He begins at the head of the line and concentrates upon the elimination of the idle time shown on the charts. In this case, it is the elimination, or at least the reduction, of the 0.58 minute of idle time by moving the templets around on the chart to obtain better balance. Figure 2 is a chart showing the results of his efforts.

It will now be observed that operation 160 remains as in the old plan; it is still the key operation with 1.66 minutes of machine time, which is idle time for the operator. The problem then, is to utilize this 1.66 minutes by adding other operations, the handling time of which will equal this time. Here the attempt has been completely successful, because the part handling times for operations 120, 110, and 170 ($0.40 + 0.80 + 0.46 = 1.66$), just equal the machine time of the key operation. This has been accomplished by taking operation 150 away from this operator and adding in its stead two new operation, 120 and 110. When these two operations have been serviced ($0.40 + 0.80$), and the part removed and replaced in the lapping machine (0.46), the gear shaving is ready for attention, and the operator is available at the right time. Element times selected from the time study observation sheet for jobs 160, 120, 110, and 170, are shown in Table II.

The cycle then repeats. Two cycles are noted on Figure I and Figure 2 for illustrative purposes. Now, it will be noted, no idle operator time is allowed; a proper cycle balance has been obtained; and the simpler pattern of operator movement is noted at the bottom of Figure 2. The operator carries one part through this sequence, and does it in a rhythmical pattern. With the split in operation 150 in the old plan, and the 0.58 minute of idle time, the job was monotonous by virtue of the interference imposed upon the operator; now the sequence is regular.

The element times mentioned do not include allowances. When the cycle time is determined, various allowances are added to obtain the task time. To include them in this discussion would only add complications; and then such additions would not be of general application, even though they satisfy these conditions very well.

Less Monotonous Job

Since this discussion did not cover a complete unit, or line, no over-all savings may be stated. However, a method of attack on idle time has been presented, and in the case used as illustrative of the method, some 15 percent of productive time was saved for productive work. At the same time, the elimination of interference resulted in a less monotonous and a more rhythmical job. The cycle charts with the machine templets afford a flexible and convenient method for quickly balancing a machine line when a change in conditions, such as a change in schedule, makes this necessary. No small part of the value of this technique results from its use for instruction purposes. The plan to be followed by the operator can easily be shown from the charts. In case of doubt as to the feasibility of the plan, it may be demonstrated, and the time distribution checked back through the time study sheet.

THE AMERICAN WAY

"The most efficient company with the lowest labor costs usually pays the highest wage rates. The efficient, mechanized, capital-consuming industry pays a higher *wage scale than hand-labor industry can afford.*"

F. D. Newbury, Vice-President, Westinghouse Electric & Manufacturing Company.

This Organization Chart Is Easily Kept Up to Date

R. R. WIESE, Administrative Engineer, Fleetwings Division, Kaiser Cargo, Inc., Bristol, Pa.

AN ADJUSTABLE ORGANIZATION CHART in use in the engineering department of the Fleetwings Division, Kaiser Cargo, Inc., Bristol, Pa., keeps employees and executives accurately informed concerning the authority and responsibility of each person in the department, and thus helps maintain the functions of all on an orderly basis.

Much of the effectiveness of this chart comes from the simplicity with which it can be revised whenever there are any changes in personnel or revisions in authority and responsibility.

The chart consists of a framed composition board panel, about 80x24 inches, to which transparent colored plastic tabs are attached, each bearing the name of an executive or employee. These are arranged in subdepartmental columns which are identified by the title typed at the top of the column.

Color Indicates Rank

The color formula used in this case is as follows:

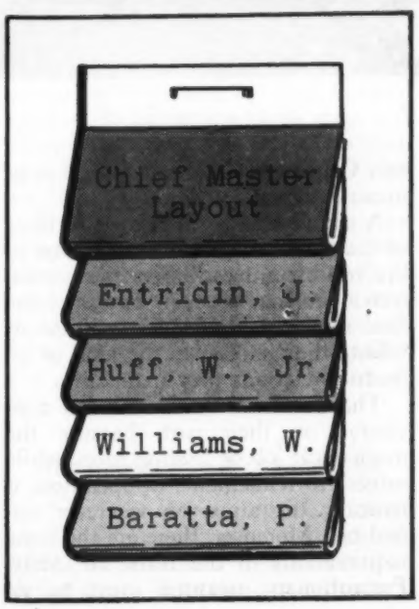
Green, supervisor's title or group; red, engineering supervision; blue, group leaders; white, assistant group leaders to detail draftsmen; amber, master layout personnel on loan; orange, laboratory personnel; pink, clerical; lemon, blueprint and templet reproduction.

Supervisory tabs are arranged in levels indicating relative position in the organization. All others in each group are arranged alphabetically.

Tabs are fastened to the board, wherever needed, by wire staples which are applied with a desk model fastening device. This holds them firmly but permits them to be removed by hand. For most changes, however, it is sufficient merely to revise the typewritten cards that fit inside the tabs.

Lines of authority are marked on the board in pencil so that if alterations are required they can be made by erasure and re-marking. Colored tapes are optional for showing the authority lines.

Approximately 350 names are used on the board, but there is ample space for many others.



Transparent colored plastic tabs fastened to a composition board with wire staples make a convenient organization chart. Names typed on card inserts are changed easily, and tabs are rearranged by removing the staples. A penciled diagram connects the various groups of names to show departmental lines of authority

Colors indicate rank and function of the man whose name appears within the tab. In this specimen, the top tab is green to designate the group classification; the next two are red to designate engineering supervision; the fourth is white for an assistant group leader to detail draftsmen; the fifth is pink to indicate a clerical employee

Industrial Relations—Key to Canadian Plant Success

L. C. MORROW, Editor, *Factory*

THE GENERAL ENGINEERING COMPANY (Canada) Limited designed and built a fuse-loading plant in the Toronto area in 1941 and has been operating it ever since. There are 5000 employees. There never has been any important labor trouble, although wage rates are moderate even for the Toronto area; other armament plants in the same locality pay more. The plant is located at Scarboro, 12 miles from the center of Toronto.

What has it been like to operate a plant from scratch? To what particular phase of operation has the management given most attention? Is there something that can be learned from this Canadian plant by our American manufacturers?

A couple of days in the plant, most of the time in the company of one of the top executives, brings the certain conviction that the men who carry the final responsibility for the venture attribute their success to the kind of industrial relations they maintain.

That would seem to be a fair conclusion on their part, because the mechanical job of loading fuses, while subject to refinements in operation, is basically the same job wherever carried on. Moreover, there are the same requirements in the realm of safety. Precautionary measures must be set up, training given, and discipline enforced. There is little equipment, so the procedure nets down to the safe handling of dangerous materials, in performing well-established routine operations, by relatively dense groups of workers, mostly women. Seventy-four percent of the employees, 90 percent of the supervisors, are women.

An Independent Union

Employees of the plant belong to the independent Munition Workers Association. Their union is known as Local No. 1, but there is no other. It bargains for all employees.

The grievance procedure in this plant is as follows:

1. When an operator has a grievance, he (or she) can

   a. Go to his supervisor.

   b. Have his shop representative take it up with the association executive.

   c. Go to a personnel interviewer or the industrial relations office.

2. The industrial relations officer may propose discussing the grievance with the plant manager or president, or

3. The association executive may make the same proposal (this has not happened).

4. Finally, application may be made by management or the association to the Department of Labor for appointment of a Board of Conciliation.

Industrial Relations Expenditures

For Three-Year Period Ending October 31, 1944

Classification of Expenditure	Percent of Over-all Operating Expenditures Exclusive of Expenditures for Subcontract Parts
Supervision	0.120
Recreation	0.040
Personnel (exclusive of employment and training)	0.400
Plant Publication	0.070
Posters	0.004
Exhibits	0.010
Special Visitors	0.004
Awards (exclusive of suggestions)	0.003
Local Propaganda	0.006
Educational Material	0.003
Miscellaneous	0.001
Total	0.661

Top Management Policies

One basic conviction of the management is that the line of authority in industrial relations must be direct from the highest ranking official to the industrial relations officer. Another is that management must move in early on anything wrong, and not let it simmer. And a third is that it is quite as important to understand the people who do the work as it is to understand the finance and equipment that make the work possible.

A lot of time has been spent on industrial relations, both in setting up and maintaining the entirely new organization. Great care has been taken to do what the management thinks is the right thing, and the personnel in charge of industrial relations has not spared itself. The money this program has cost is "only 0.26 percent of our total expenditures and 0.66 percent of expenditures made, eliminating the cost of the empties which are supplied to us from other factories. This would be 4.2 cents per hour added to the production operators' wages. It covers all the activities of the industrial relations department, with the exception of the employment office"—according to the president. The expenditures for industrial relations are itemized above.

Senior management (president and vice-president) put in a great deal of time on industrial relations in the early days of operation. They still put in considerable time, relatively. But senior management delegates most of its authority to an industrial relations officer. Both senior management and industrial relations officer are committed to the policy of giving unlimited attention to the many matters, most of which do not entail great expense, but which, taken together, provide good working conditions and an amount of contentment among employees which money cannot buy.

Outward appearances count in giving the industrial relations officer standing in the eyes of employees. In this plant he has the authority for approving requisitions and authorizing payment for expenditures relating to industrial relations matters. He must approve all recommendations for rate changes for other than operator groups up to fairly high senior officials. (Recommendations for rate changes for operators originate in the shop, but must be approved by the group superintendent.) The industrial relations officer is one of six executives (president, vice-president, plant manager, assistant plant manager, production superintendent are the others) who have the authority to sign visitors' passes. He has access to all wage and salary records, which puts him in position to maintain a balance between wages and salaries.

The procedures followed in the company's conduct of industrial relations are reported here. No analysis of what is good and what is bad, if anything, is attempted. The details are given and the combination of policy and action that they reveal is allowed to tell its own story.

Services for Employees

There are certain routine services which any well-run plant makes available to employees. Others are peculiar to the work. Here the services are:

Cafeteria. A great many people get two or three meals per day. Others get only lunch. Meals are served at stated hours only, but at one end of the cafeteria room is a spot given over to the continuous serving of light refreshments—bakery goods including muffins and cup cakes, ice cream, fruit, coffee, tea, and milk.

Medical Examination. Applicants' eyes are examined and applicants with impaired vision are referred to the proper agencies for correction. Applicants are given a medical examination, but minimum requirements are not severe. Canada is scraping the bottom of the barrel. Record cards show the defects of these applicants (poor eyesight, poor legs, poor back, hernia, age). Placement is made with due consideration for these shortcomings. Otherwise the new people are put where they are needed, without recourse to aptitude or other tests. There is no prejudice against tests; under the conditions of today such choosiness is out of the question.

Group Hospitalization. About 60 percent of the employees voluntarily participate in the hospital plan.

Uniforms. The company supplies and launders uniforms. Basically all uniforms are alike. A turban of a distinctive color indicates that the wearer is a government inspector. Colors on belts indicate departments.

Safety Shoes are supplied by the company for all personnel working in departments where explosion hazard exists. They are shoes containing no metal. They always stay at the plant

in lockers or on shelves. A shoe repair department, in addition to routine repair work, builds in arches and supports when needed and renovates the safety shoes of departing employees.

Music is played in the plant during 10 minutes of each working hour. It is supplied by a wired service and the programs are mixtures of modern dance tunes, patriotic music, and old favorites. Apparently this formula suits, because there has been no griping. When the music is not being played, the employees in a group are as likely as not to do considerable singing on their own. (Relatively small groups in individual rooms make this feasible.)

Shift Rotation. The great majority of employees rotate shifts. However, hardship cases are permitted to stay on the same shift all the time. The stagger-hour system is used in order to insure bus and cafeteria service for all. Buses from the plant feed city transportation lines, and staggering is necessary to spread the load.

Recreation

Akin to an employee service, but not rated as one here, is recreation, considered an activity that the management believes has a wholesome influence upon industrial relations. Ten people constitute a Recreation Directorate. One of them represents engineering, 4 represent factory workers, 1 represents the administration staff, 1 represents purchasing, 1 represents accounting; the director of women's personnel and the industrial relations officer are *ex-officio* members.

During the random week ending October 5, 1944,

212 people participated in recreation activities at the recreation center in outdoor activities, of which there were available volleyball, badminton, horseshoes, lawn bowling, croquet, softball, golf.

896 participated in indoor activities at the center, choosing among golf practice, table tennis, shuffleboard, badminton, volleyball, darts, dancing, singsongs, parties, glove making, organization meetings, bingo, sports meetings, movies, health and beauty classes.

469 participated in outside-sponsored activities (away from the center). They had available riding, swimming, bowling, dramatic club, broadcast programs, tennis, softball games, softball practice.

152 participated in lounge games—cribbage, checkers, bridge, euchre.

Total of participants, 1729.

Duties of Interviewers

Typical of the thoroughness with which industrial relations matters are gone into, are the duties performed by interviewers:

1. **Personnel workers interview and follow up on such problems as:**
   - a. **Advice on child care (day nursery, foster homes, recreation)**
   - b. **Vacation plans for employees and their children**
   - c. **Arrangements for suitable living quarters**
   - d. **Welfare and domestic problems**
   - e. **Arranging recreational activities**
   - f. **Transportation difficulties and special plans**
   - g. **Arrangement of transfers between production and other departments**
   - h. **Transfer of operators from full-time to part-time work and *vice-versa***
   - i. **Questions and complaints regarding any service**
   - j. **Adjusting to shop environment**
   - k. **Letters to American consul for employees wishing to visit the United States**
   - l. **Requests for visitors' passes**
2. **Separation interviews for employees and investigation of these through discussion with supervisors, foremen, and group office in an effort to retain competent operators.**
3. **Follow-up on employees by shop visits and other contacts to ascertain how employees are adjusting. This is particularly necessary with special groups such as temporary summer employees, recruits from distant points, part-time workers, elderly or very juvenile employees, and individuals with special problems.**
4. **Speedy delivery to operators of urgent messages, reduction of shock to minimum, arrangements for medical assistance and transportation home if necessary.**
5. **Cooperation with medical department and visiting nurse on health problems.**
6. **Liaison work with foremen and supervisors regarding employee problems, plant conditions, and company policy.**
7. **Follow-up on unsatisfactory reference letters.**
8. **Introduction of new employees.**
9. **Maintaining file of information on community welfare resources.**
10. **Reports:**
    - a. **Personnel interviewer's weekly summary of current problems and suggestions.**
    - b. **Weekly statistical reports, summary of resignations and labor turnover, with analysis indicating turnover in individual shops.**
    - c. **Reports to industrial relations officer and the management on special problems and on particular groups of employees.**

Training

Each new employee who is intended to become an operator attends an induction school for a half day. She is outfitted, fingerprinted, told about the company services, given an outline of safety regulations, instructed concerning the method of pay. Three days later the operator attends a questions-and-answers session.

On-the-job training is given operators by supervisors who, with many bench leaders, have taken the standard Job Instructor Training, Job Methods Training, and Job Relations Training originated by the Training Within Industry Division of the United States War Manpower Commission.

Some operators continue to be operators, of course. Others are promoted. The step above operator is bench leader. Some bench leaders, picked because of leadership qualities in addition to other qualifications, are given a two-week course in handling people, company policies, and operating details. These people become assistant supervisors and later on, if satisfactory, supervisors.

Assistant foremen are made from the ranks of the supervisors. They are given a one-month course of intensive training in practical work, records, ad-

ministration. They also have a series of study sessions with the heads of functional departments—purchasing, accounting, stores, maintenance.

In all upgrading and promotions, the work record card, about which more later, plays an important part.

Job Classification

Job rating is in effect, but it operates within prescribed limits. The government froze all rates as of a specific date. Following that action, all changes had to be made by appeal to the regional war labor board. As a basis for presenting claims the company filed its existing job classifications and rates.

For regular jobs there are 22 job classifications—3 operator, 2 skilled operator, 2 leader, 4 assistant supervisor, 4 supervisor, 4 assistant foreman or assistant superintendent, 3 foreman or superintendent. There are 10 types of special operators with 8 grades of operators.

Work Simplification

Work simplification is a function of the operations study department. There is ample evidence of methods improvement; some of it represents improvement made by the department as routine work, some represents improvement made because of proposals presented as a result of stimulation by the suggestion system.

No Money Incentives

Money incentives are not used in this plant. That is a deliberate choice by management, and it was made for reasons of security. Enough high explosive is used in the loading of fuses to make excessive speed in handling dangerous. Even with rates high enough to return good pay for unhurried and safe work speeds, it was thought that some over-zealous worker or someone working erratically might jeopardize the lives of employees.

Recognition as Incentive

When an employee has worked a year a red diamond is sewed to the shoulder of her uniform. A green diamond is added at the end of the second year, a blue at the end of the third. A gold diamond is substituted for the three at the end of the fourth year.

Letters of congratulation from company foremen and executives are used effectively. Here are samples:

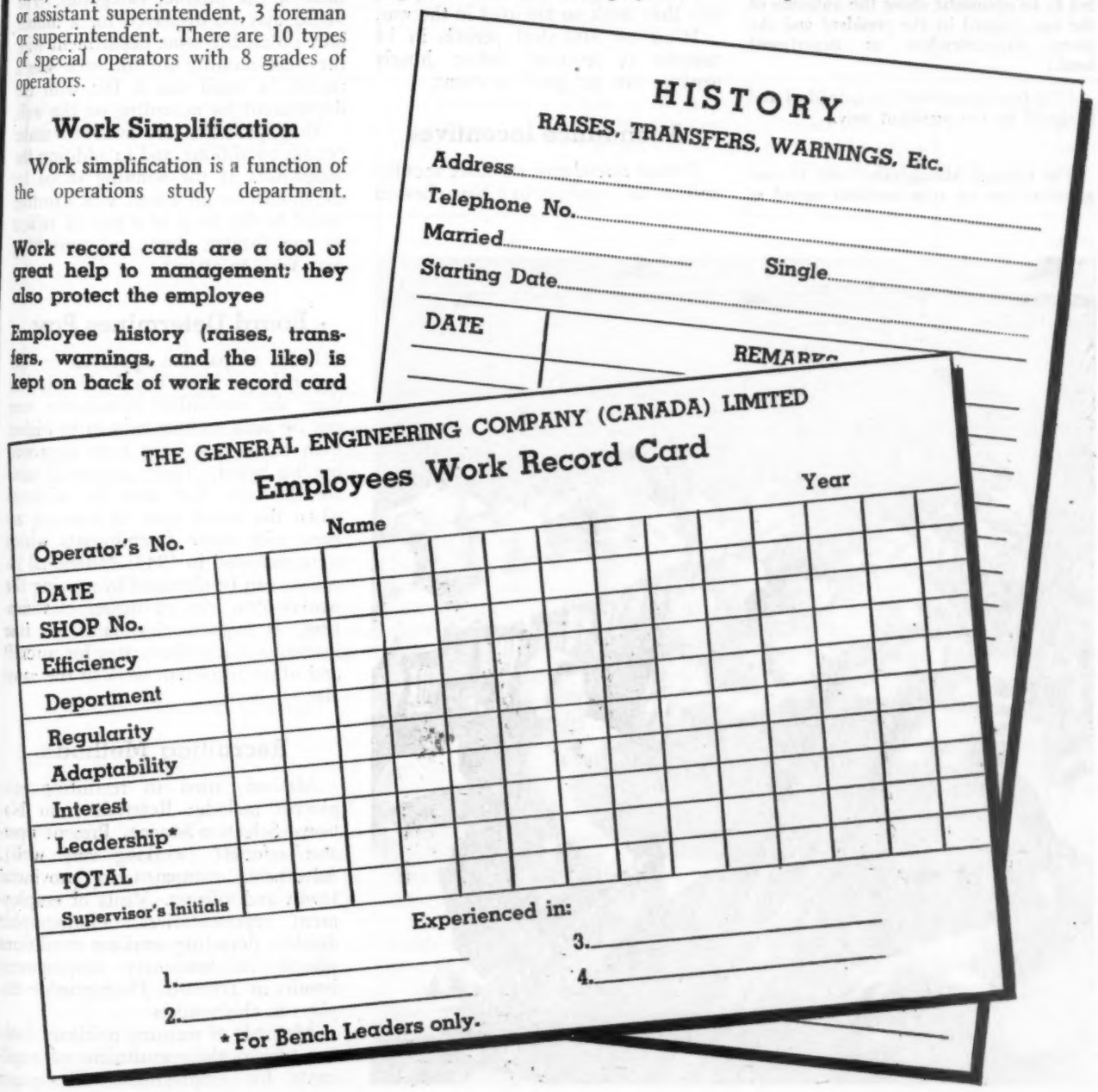
1

The first year of your association with this company has been reached and we want to thank you for your cooperation and interest in helping to get the job done.

It is the efforts of the ones who stay at it that count in the long run. (Signed by the president and the foreman.)

Work record cards are a tool of great help to management; they also protect the employee

Employee history (raises, transfers, warnings, and the like) is kept on back of work record card



CONTINUED ON NEXT PAGE

2

May we take this opportunity of congratulating you upon completing your second year with this company.

The success of this and many other projects across Canada, engaged in the production of war materials, is in no small measure due to the sacrifice and loyalty of our Canadian war workers.

Greatly appreciating your past services, we now ask you to help us finish the job.

We thank you. (Signed by the president and the group superintendent.)

3

On this occasion of your third completed year with this company, we extend our congratulations and express our most hearty appreciation for your length of service. Your record is one of which we are justly proud.

Through the steady and unrelenting efforts of employees like yourself in this and other war industries, we are permitted to be optimistic about the outcome of the war. (Signed by the president and the group superintendent or department head.)

(The fourth year letter is individual and is signed by the president only.)

4

The General Management wish to congratulate you on your excellent record of punctuality and attendance at this plant during the last year, during which time you were neither late nor absent. Your record indicates a loyalty to the cause for which we are all working that should be an inspiration not only to the employees of our own plant, but to all war workers of the united nations.

May we take this opportunity of expressing our appreciation of the work which you are doing and also the hope that you can continue your splendid effort until we finish the job. (Signed by the general managers, who are also the president and vice-president.)

The company attests to ample evidence that these letters are appreciated and that they are being carefully treasured to be used as references after the war.

As a recognition of good attendance, 200 employees at a time are sent to the proof range to see how the products they work on are used in the war.

Work on 300 shift periods in 14 months is required before hourly workers can get paid vacations.

Attendance Incentives

Perfect attendance for three months entitles an employee to a blue chevron to be worn on the sleeve. Perfect attendance the second three months gives her a second blue chevron, and a third can be obtained at the end of another three months of perfect attendance. A red chevron replaces the blues at the end of a year of perfect attendance. If the attendance record has been for consecutive periods during a year, a wide bar is given for the sleeve and two additional items of recognition are received—a wallet and a letter from the president.

Housekeeping Incentives

Departments receive shields for good housekeeping. A month's best record entitles the department making it to display a large shield. A shield is awarded to the best department in each of the product categories. The shield may be displayed for a month only unless the same department wins the next month; but for each win a replica in small size is left with the department for mounting on the wall.

Shop pennants are awarded under certain conditions, and in addition the supervisors of the winning shops for the month are presented with a further award in the form of a pair of tickets to any theater, show, or game they may wish to attend.

Board Determines Pay

Rates of pay are approved by the regional war labor board. While less than the established minimums may not be paid, neither may rates higher than those that have been approved by the board. These approved rates are the rates that were in existence when the board took its freezing action, with some amendments which were approved in 1943. Individual increases can be obtained by moving the worker into jobs of higher classification. It happens that rates for fuse loading are less than rates for aircraft and other armament work in the same city.

Recruiting Methods

Methods used in recruiting employees include: Referrals from National Selective Service. Present operator referrals (working very well). Advertising campaign in provincial towns and villages. Visits of employment representatives. Photographic displays depicting working conditions placed in temporary employment booths in Toronto. Photographic displays in chain stores.

Methods of securing publicity looking toward the recruitment of applicants for employment: Newspaper

Breakdown Used in Marking Operator Work Record Card

	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT
Efficiency	Below average in quantity and quality of work. Needs constant supervision. 1-10	Reasonable in quantity, quality. Requires fairly constant supervision to carry out work. 11-20	Average worker, steady, reliable. Requires general shop supervision. 21-30	Good worker, few rejects, fairly quick. Requires a little general supervision. 31-40	High quality and quantity of work. Little or no supervision required. 41-50
Deportment	Disregards G.S.D.'s and plant regulations, causes trouble in shop. 1-2	Occasionally disregards G.S.D.'s, plant regulations, or upsets shop discipline. 3-4	Observes G.S.D.'s and plant regulations, occasionally upsets shop discipline. Pleasant working associate. 5-6	Observes G.S.D.'s and plant regulations. Rarely upsets shop discipline. Pleasant working associate. 7-8	Maintains perfect discipline and observance of G.S.D.'s. Pleasant working associate. 9-10
Regularity	3 or more absences in two-week period. 0	2 absences in two-week period. 5	1 absence in two-week period. 10	1 absence in two-week period. 10	No absences in two-week period. 15
Adaptability	Change of job retards work unduly, slow to learn. 1-3	Can be changed, but learns slowly. 4-6	Able to change. Learns with average speed. 7-9	Able to change. Flexible. Can do several jobs and learns fairly easily. 10-12	Very flexible. Can be used on many jobs, and learns new duties easily. 13-15
Interest	Negative, indifferent attitude. 1-2	Neutral attitude. Work is secondary consideration. 3-4	Reasonable attitude to changes, transfers, etc. 5-6	Cooperative attitude generally. Shows desire to gain information and knowledge. 7-8	Very cooperative towards improvements, production, and morale. Keen to acquire knowledge. Ambitious. 9-10

Cards are marked upon the basis of a total of 100 points allocated under the five headings shown. Operator rates are subject to the following gradings: Grade C, 50 points or under; Grade B, 51 to 60; Grade A, 61 to 80. The same principle is used in grading skilled operators, leaders, and supervisors

publicity; visits of important people; National Selective Service; radio publicity; general publicity; talks with outside organizations; store publicity; publication of employee human interest stories; street car and bus advertising.

Work Record Cards

Work record cards are a tool of great help to management; they are also a protection to the employee. There is a card for each operator and each supervisor. The objective is to provide a systematic record of the work, ability, and progress of each employee as a basis for adjustment of the hourly remuneration.

Cards are marked upon the basis of a total of 100 points allocated under five headings: Efficiency, deportment, regularity, adaptability, interest. Operator rates are subject to the following gradings: Operator Grade C, 50 points or under; B, 51 to 60 points; A, 61 to 80 points. The same principle is used in grading skilled operators, leaders, and supervisors, but details differ. The "Card-Marking Breakdown for Operators" is illustrated.

From the standard instructions regarding work record cards the following excerpts are taken:

Standardization in marking cards is essential and one person is responsible for coordination of this work. It is also the duty of this person to study wage levels and wage analyses.

An operator may ask to review her card with the supervisor, but under no circumstances may an operator review the card of another operator.

Cards are marked every second Wednesday by supervisors in the presence of their assistant foremen.

To receive a promotion, an operator must achieve and maintain for two consecutive periods marks commensurate with the grade above her own before advancement to the corresponding hourly rate for that grade is made.

An operator must be advised at the end of the first period in which marks have not been maintained and is demoted at the end of the second consecutive period in which marks have not been maintained.

An absentee record card, on which all absences are entered daily, is attached to the work record card and from this record regularity marks are calculated.

Manual of Procedure

Essential component in the industrial relations program is the "Manual of Procedure." Some fifty copies are stencil duplicated. Both the scope of the content of the book and the extent of its distribution are significant. Each department head receives a copy. Binders are provided, the sheets are punched, and each recipient is respon-

sible for seeing that additions and revisions are put into the binder.

The six major chapters are: Management; Operations; Administration; Safety; Engineering and Maintenance; Fire Procedure.

Pertinent parts of the manual are distributed much more widely than to department heads. For example, some of the information must be placed on bulletin boards. Again, some must be put into the hands of production foremen and assistant foremen.

The manual was developed to set out as concisely as possible the routine to be followed by each department. It is necessary for the industrial relations department to be able to become informed without delay on any matter of routine in any department. Likewise, each department head should be able to find out without delay how to handle routine personnel matters.

There is no chapter or section labeled Industrial Relations. Obviously industrial relations permeates every department. All the little pieces of procedure that deal with human relations, if they were drawn out and put together, would constitute the industrial relations practice of the company, but it is considered that they are most effective as now presented. The organization chart specifies as the responsibilities of the industrial relations department: Personnel and Employment; Security; Transit and Communications; Messengers; House Organ; Public Relations; Recreation.

Each of the six chapters of the manual is divided into sections of which there is a total of sixty-six. An alphabetical index is provided.

Absenteeism

Absenteeism, as treated in the manual, affords a good example of how subjects are handled, because of its brevity as well as its thoroughness. It is a two-page "Subject" under the section "Employee Rules," itself a part of the chapter "Management." This subject consists of a listing, with a description in each case, of the absentee forms used by the company. There are 16 of them, as follows:

Medical Slip
Absentee Punch Card
Absentee—Daily Report
Absentees—Daily Summary
Request for Leave of Absence
Telephoned Absentee Reports
Record of Employees on Leave of Absence
Time Card Release Form
Absentee Referral Slip
Quittal Referral Slip
Notification to time office that a salaried employee has completed National Selective Service forms and the date when service will terminate
Notification to time office that an hourly paid employee has completed N.S.S. forms and the date when service will terminate
Notification to time office and other departments concerned of cancellation of resignation and N.S.S. forms
Clock notification to employee going on vacation with pay. (This card is left in time card rack while employee is on holidays.)
Personnel Returning Absentee Form
Absentee Check Release Form

Duties of Officers

The industrial relations department has its own instruction sheets on which are given the names of the people making up the department and their duties. There are 17 officers assisted by a staff of 26. In condensed form here are the officer titles and department duties:

Industrial Relations Officer. General supervision of industrial relations department. Assists plant managers in matters other than production and engineering. In charge men's employment and personnel. Deals with labor rates, working conditions, vacations, correspondence with regional war labor board. Deals with changes of rates other than high-bracket salaried. Is a member of the security committee and receives all security reports.

Special Assistant to Industrial Relations Officer (Statistics, Recreation). Preparation and transmission of reports on absenteeism, employment, security, and other personnel matters. Publicity and entertainment; propaganda visits; newspaper liaison. Organize Victory Loan campaigns. Direct absenteeism procedure. Handle special assignments connected with personnel matters.

Special Assistant to Industrial Relations Officer (Transit). Gasoline rationing. Buses and employee transportation. Insurance, cars, accidents, trucks. Leases on properties. Advertising contracts. House organ. Teletype, switchboard, messenger service. Activities committee.

General Assistant to Industrial Relations Department. General correspondence. Secretary and member of suggestion committee. Manpower registration and surveys. Military service deferments. Editing and issuing manual of procedure. Agenda and minutes of staff meetings. Projecting wage and salary schedules.

Director of Women's Personnel Work. Women's employment. Responsible for welfare of female employees and for clerical, statistical, and stenographic work relating to the women's personnel division. Liaison on publicity matters. Special advisory capacity as required.

Assistant to Director of Women's Personnel Work. In charge of all female interviewers, and stenographic office staff employed on personnel work. Prepares reports on personnel problems or investigations.

Interviewers. National Selective Service forms. Separation interviews. Reception of new employees. Service badge issues. Changes of address and name. Liaison with plant foremen and supervisors. Follow-up on new employees and special groups.

Absentee Follow-Up. Title indicates duties. Also supplies names for visiting nurse service.

Visiting Nurse. Makes approximately 50 calls per week on absent employees.

Personnel Records and Statistics. Title indicates duties.

Male Employment. Receives requisitions for male employees. Interviews applicants, arranges medical appointments, prepares employment documents, arranges for induction. Maintains records of male employees.

Male Personnel. In charge of men's personnel activities, and assists "Male Employment" when required.

Director of Recreation. Coordinates activities of all recreational clubs such as softball, bowling, hockey.

Assistant Director of Recreation. Performs duties indicated by title. Receives out-of-town recruits.

Editor Plant Publication. Title indicates duties.

Public Relations. Maintains liaison with press and radio and with women's personnel department. Secures and develops human interest stories of employees and their families and arranges for publication of such stories as an aid to general publicity. Assists editor of plant publication. Reports to assistant industrial relations officer.

To what extent each of the steps in industrial relations as carried out by General Engineering influences the smooth operation of the organization and the enviable production record of the plant is not measurable. It is a simple matter of record that they work in combination.

Motion-Economized Fixtures for Quicker Assembly

HAROLD ENGSTROM, Supervisor of Standards, Bendix Radio Division of Bendix Aviation Corporation, Baltimore

Low-cost tools now being widely used on assembly lines at Bendix Radio, Baltimore, permit full advantage to be taken of the principles of motion economy, thus play a major role in making high production possible. Wartime schedules could scarcely be met without them.

Tooling up for assembly operations is of the utmost importance at this plant. Many of the tools involved, however, are of a semi-permanent nature—that is, they are constructed for the life of the model, which may be exceedingly brief. Time is therefore a prime factor in their design and development. They must permit a good quality of workmanship and yet be liquidated during the life of the particular order for which they are built. For that reason, they are customarily constructed of wood, fiber, or plastic, and are not the type of tooling ordinarily associated with the tool designer and the toolmaker. They are often referred to as "gadgets."

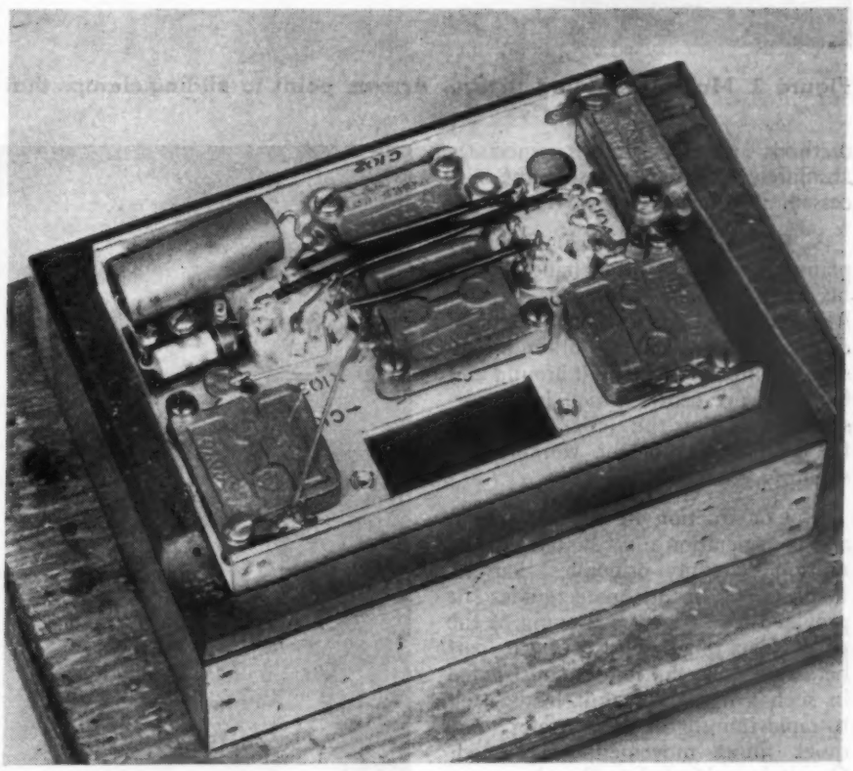


Figure 1. Single holding fixture. Part is slid in. No clamps needed

Designed for Holding

Now the dictonary defines a "gadget" as "a contrivance for doing something." That something, in the case of these assembly tools, is holding the part and permitting the operator to assemble necessary parts to it quickly and at no sacrifice of quality workmanship. The gadgets used by Bendix range in complexity from the simple holding device of a hole bored in a piece of wood to the more involved fixture consisting of several types of holding mediums in one unit. Too much time cannot be spent in making elaborate drawings, but this does not preclude the necessity for prudent planning and thinking. Carelessness from this point of view can result in serious errors, both from the standpoint of high cost and operator morale. Operators soon become discouraged when supplied with poorly devised work implements.

Because of the unorthodox methods of designing these holding fixtures, few standard practices have been written concerning them. There are certain general factors, however, to consider. They are: (1) Purpose of tool; (2) sequence of operation involved; (3) relation to workplace; (4) construction of tool; (5) type of tool.

1. Purpose of tool. Thought must be given to the accuracy and tolerance necessary in the construction of the part for which it is intended. It would be foolhardy to expect close tolerances with wood or fiber fixtures. Sometimes close tolerances may be kept by the introduction of metal inserts, but when this is done the additional cost, as well as the reliability and quality of the job, would often make an all-metal fixture more practical. The nature of the assembly parts themselves must be given careful thought. If they are parts that have high finishes, attention must be given to the finish of the tool so that it will not mar or deface the part. If the parts worked with are light or delicate, any clamping devices that distort them naturally destroy the usefulness of the tool. If the fixture is to be handled, lifted, or carried, by the operator, weight is an important consideration. When several subassemblies are to be joined so that each part is in proper relation to the other, thought must be given whether or not the fixture will hold the tolerances sufficiently close. Complications occur as the type of fixture becomes more involved.

2. Sequence of operation. The design of the tool hinges on the operation break points decided upon by time study. This procedure also establishes the time limit for the operation performed with the tool. For this reason, close cooperation of the

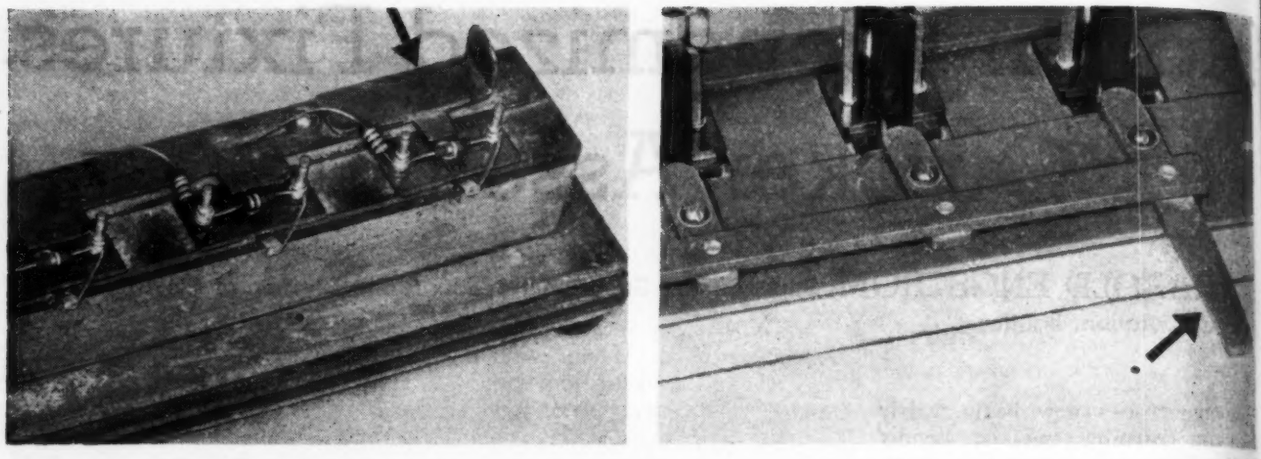


Figure 2. Multiple holding fixture. Arrows point to sliding clamps that clamp several pieces in one motion

methods and time-study engineers is absolutely essential to insure the success of the device.

3. Relation to workplace. Carefully planned tooling is often handicapped because of poor workplace layout. Material trays, pre-positioned utensils, drop deliveries, and all other associated features must be built around and for the work center which is the designed tool for the job. Otherwise the effectiveness of the workplace is seriously reduced.

4. Construction of tool. Thought and consideration must be paid to the motion economy principles that are involved. Can adequate guides be provided for simple positioning of the part? Can quick release of the part be assured? Is the fixture constructed in such a manner that it lends itself to rapid training of the operator? Are quick finger movements facilitated? Can it be subjected to the close scrutiny of a left- and right-hand analysis?

5. Type of tool. Whenever possible, tools should be classified. This assures standard construction and the economies usually associated with standardization. For electrical assemblies, the following classifications have proved useful:

A. Single holding fixture (Figure 1) holds one assembly in position for the operator to perform the operation. This fixture may be made so that the part or assembly is slid into it with or without clamps holding it. Shape and depth are of course determined by the type of part. Fixture is lined with felt or other soft material if the part may be marred.

B. Multiple holding fixture (Figure 2) holds two or more parts for assembly. This type of fixture is desirable for small parts. Aside from holding the device, it develops two-handed rhythm and eliminates unnecessary transports.

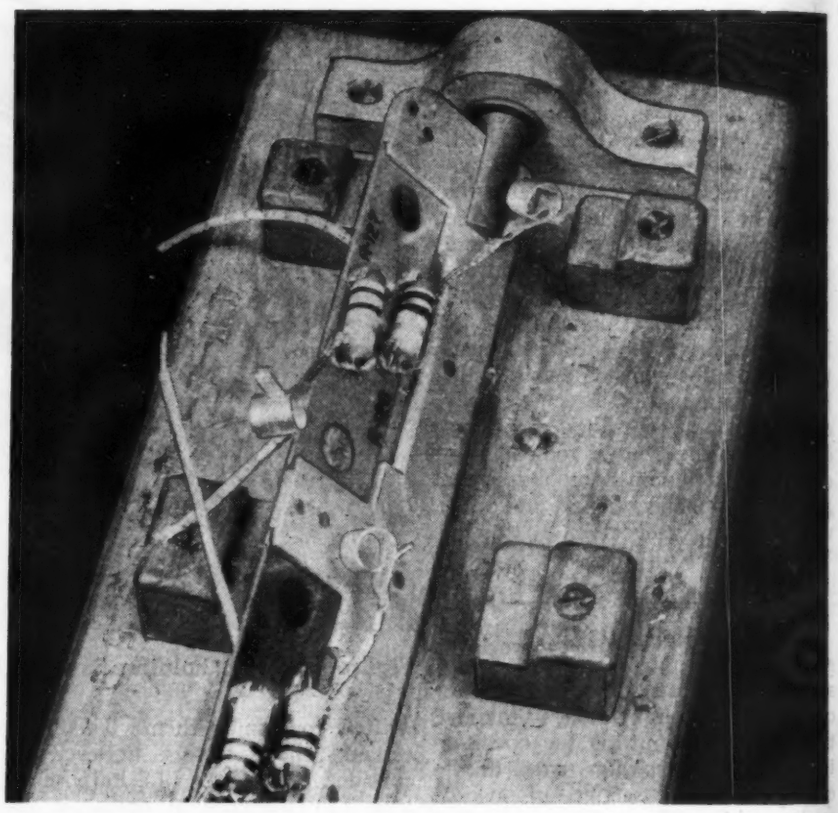


Figure 3. In the 180-deg. turn-over fixture, parts can be worked on from both sides without the operator's grasping or repositioning

C. The 180-deg. turnover fixture (Figure 3) is usually one that permits the holding of two or more assemblies in such a fashion that the part can be worked at from both sides without the operator's being compelled to grasp the piece and reposition it.

D. Revolving fixture (Figure 4) is one in which the part is held in such a manner that it can be rotated during the assembly operation.

E. Unit assembly fixture (Figure 5) is a combination locking and holding fixture for previously built assemblies so that they can be joined together in their proper relationship. Fixture shown has ten units being assembled to a finished cable.

Innumerable variations are possible from these five standard types.

In designing these fixtures, the use of molding clay is quite helpful. By placing the part into the clay, it gives immediately an idea of its cutout construction.

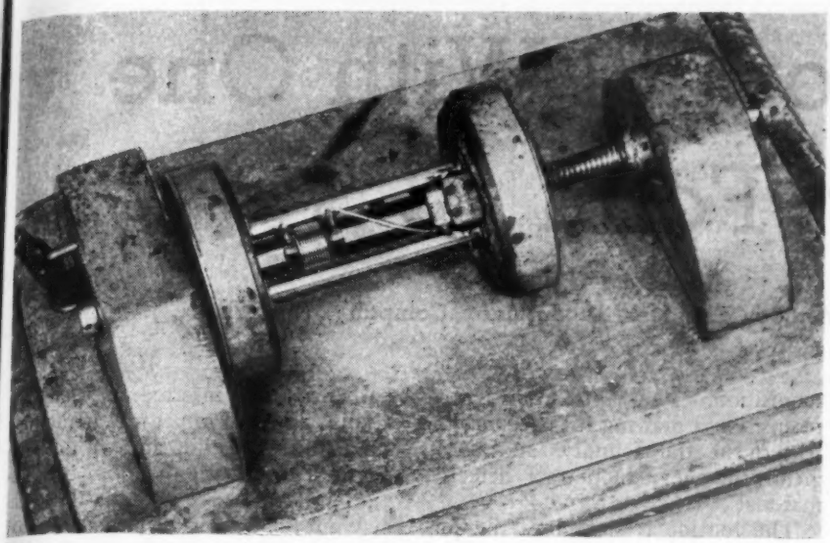


Figure 4. Revolving fixture permits rotation of part during assembly

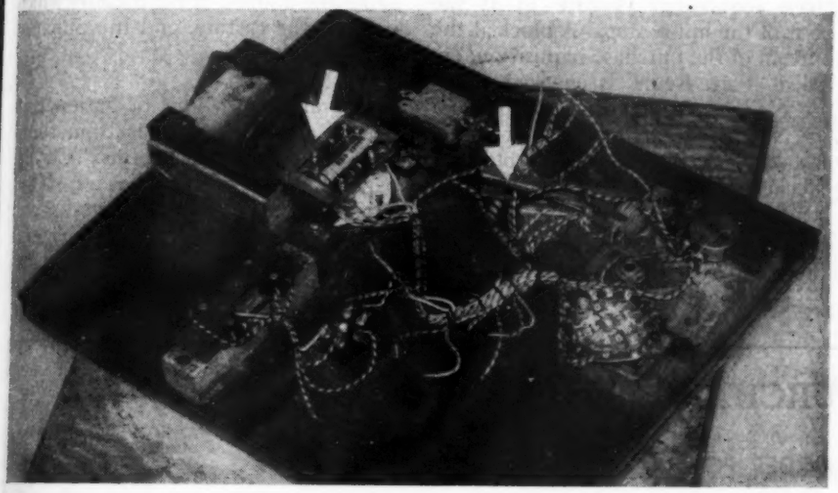


Figure 5. Swivel-type unit assembly fixture is a combination locking and holding device. Here ten units are being assembled to a cable. Arrows mark sliding plate (left), spring clothespin clamp (right)

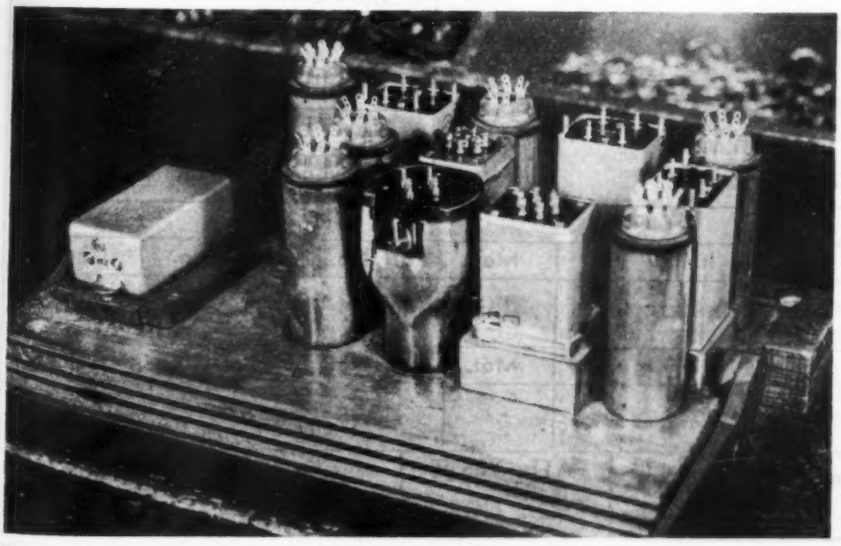


Figure 6. Here parts are held in position, chassis is placed over them. After parts are fastened to chassis, levers lift out assembly

To assure standardization in design, it is wise to specify that the fixture types be made of close-grained hardwood such as maple. These may be mounted on plywood, which in turn is provided with rubber supports in the corners to prevent sliding. The wear surfaces are made of red fiber without any application of high-finish varnish or paint. Any finish that reflects light makes it difficult for the operator. Clean-out holes are made whenever possible so that the fixture may be kept clean.

Frequently angle blocks attached to the fixture itself provide a means for turning and repositioning the assembly. Swivel types may also be made for the same purpose by attaching the fixture to the underlying base by means of a center bolt (see Figure 5).

Where a part has to be positioned on a pin, positioning pins which are made self-centering by an addition of a spring to the end are most valuable. They allow for minor-size deviations of formed parts.

In the rotating type of fixture, it is often necessary to index the fixture at certain locating points. Low-cost ⅜-in. spring button insert pins can be satisfactory for this purpose.

Clothespin Clamp

Ingenious clamping devices can be developed—for example, the ordinary spring clothespin shown in Figure 5.

All corners are rounded, and quick-release and locating mechanisms are used whenever possible. Release levers may be fashioned out of fiber as in Figure 6. In this particular fixture the parts are already held in position awaiting the succeeding operation of placing the chassis over them. After the parts are fastened to the chassis, the levers lift out the entire assembly.

Sliding clamps that clamp several pieces in one motion are also used. Figure 2 shows two sliding clamps developed at Bendix.

The proper spacing of parts may be controlled in some cases by using sliding plates which fit on to or over the worked parts in the assembly fixture (see Figure 5).

The skilled craftsman in pattern work, together with the methods engineer, can develop many ingenious low-cost tools of this type. Simplicity is a prime consideration, not only from the cost standpoint but also from the operation standpoint. The carefully thought-out tool reduces learning time as well as fatigue. Care should also be taken in respect to the limitations involved in this type of tooling because, where close tolerances are demanded, it will not suffice.

Pattern Control With One Five-Part Form

WILLIAM F. BUHL, Methods Engineer, Lecourtenay Company, Newark, N. J.

EFFICIENT CONTROL of the movement and storage of patterns is essential to maintain a production schedule, especially where the use of many types of materials necessitates the transferring of patterns from one foundry to another. To enable Lecourtenay Company, Newark, N. J., to keep this record with a minimum of clerical routine, the system outlined herein was designed. It provides a complete history of patterns and entails surprisingly little paperwork.

The plan revolves around a special 5-part form with carbons inserted, which provides the necessary records. This form provides also a label for the shipment of the patterns, a delivery receipt, and a packing list, in addition to the pattern record slip and the print requisition. The last item is used to requisition a drawing for checking the pattern at the foundry, and assists greatly in the reduction of defective materials.

The routine is started in the purchasing department, after the typing of the purchase order, and the purchase requisition (Figure 1) is the basis of the initial step. A block at the bottom of the purchase requisition, entitled "Patt. Req.," is checked "Yes" or "No" by the requisitioning person. If "No" is checked no further action is taken. However, if the block is checked "Yes," the cycle of operations begins.

Operation 1. A 5-part form of snap-out type (Figure 2), with one-time carbons already inserted, is typed. The form is designed to permit rapid typing on a continuous line and with a minimum of information. From the illustration it can be seen that all the essential information is furnished, in that the name of the part, its number, and the material are shown, as well as the name and address of the foundry which is to do the casting, and the purchase order number.

Operation 2. This operation consists of removing carbons from forms and distributing the forms. Certain parts of the form stay together. Thus copies 1 and 2, the delivery slip and label, remain intact; copy 3, the print requisition, is separate, while copies 4 and 5, the pattern record and de-

2
PURCHASING

PURCHASE REQUISITION

ISSUE ORDER FOR MATERIAL LISTED BELOW:

(RESERVED FOR PURCHASING USE) SPECIAL NOTES:	PRICE	PUR. APPVL.
	F.O.B. POINT Newark	
	PUR. ORD. NO.	B 6857
SUPPLIER: Associated Foundries, Inc. 5674 Blank Street, New York		
	DELVY. REQ.	9-16

ISSUE ORDER FOR:

Qu.	Cat. No. or Size	Item	Mat.	Patt. No. or Comm. No.	Charge
1		Casing	C.I.	14-5-6-2	18596
To Make	**Cat. No. or Size**	**Item**	**Mat.**	**Patt. No. or Comm. No.**	**Charge**
1		Casing		14-5-6-2	18596

In Stk.	No Stk.	Raw Mat.	Remch.	In Process	PATT. REQ.	SIGNED
	x				YES ☒ NO ☐	

Figure 1. The job of keeping track of patterns starts in the purchasing department, after the typing of the purchase order. The purchase requisition shown here is the basis of the original step

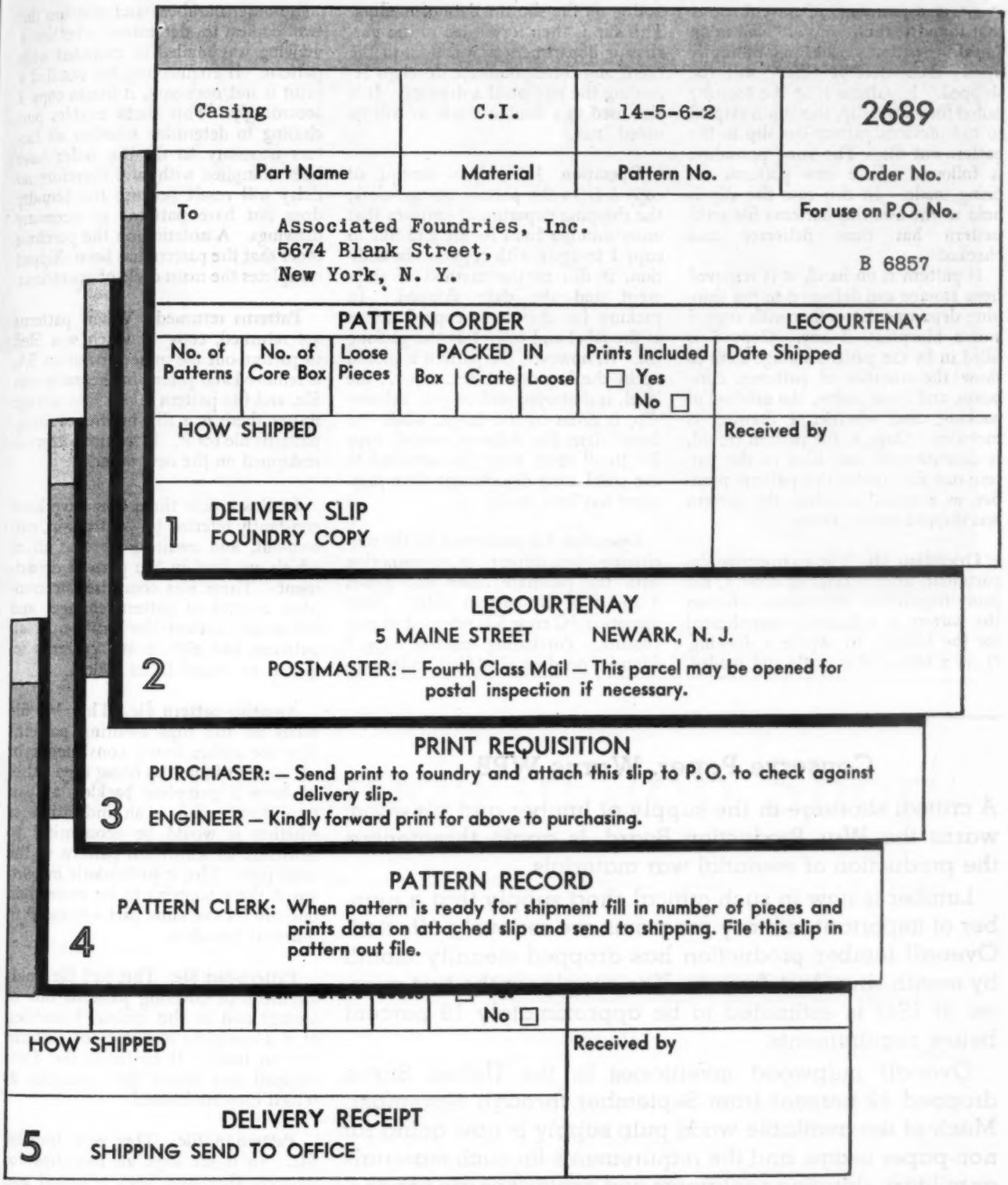


Figure 2. A snap-out 5-part form, with one-time carbons already inserted, furnishes all essential information, serves as delivery slip, label, print requisition, pattern record, and delivery receipt

livery receipt, also remain together. These forms are distributed as follows: Copies 1 and 2 are sent to the shipping department, where they are filed under the order number. Copy 3 is sent to the engineering department for the preparation of a blueprint, if required, and copies 4 and 5 are sent to the pattern shop.

Operation 3. This operation is divided into three divisions because the routine proceeds in three departments at the same time. For ease in following the flow, however, they are explained individually, as operations 3A, 3B, and 3C.

Operation 3A. In the pattern shop, parts 4 and 5 are given to the pattern storage clerk, who checks the loft to see if the pattern required is on hand.

If the pattern is not on hand, the clerk checks the "pattern-out" file (to be described in more detail later) to determine its location. If pattern is located at a foundry that no longer has any need for it, it is recalled. In this

event, or if pattern is in current use at that foundry, these slips are filed in an "awaiting-patterns" file and promptly upon their receipt they will be shipped. If pattern is at the foundry called for on the slip, this slip is stapled to the previous pattern-out slip in the pattern-out file. The same procedure is followed where new patterns are being made. In this case the slip is held in the awaiting-patterns file until pattern has been delivered and checked.

If pattern is on hand, it is removed from storage and delivered to the shipping department together with copy 5 and a blueprint, if any. Copy 5 is filled in by the pattern storage clerk to show the number of patterns, core-boxes, and loose pieces, the method of packing, and whether a drawing is included. Copy 4, the pattern record, is date-stamped and filed in the pattern-out file, under the pattern number, as a record of when the pattern was shipped and to whom.

Operation 3B. The engineering department, upon receipt of copy 3, the print requisition, determines whether the pattern is sufficiently complicated for the foundry to require a drawing. If so, a blueprint is made and mailed, noting on the slip the date of mailing. This slip is then forwarded to the purchasing department as a record, in the event any correspondence develops regarding the receipt of a drawing. It is also used as a double-check, as will be noted later.

Operation 3C. Upon receipt of copy 5 from the pattern storage clerk, the shipping department removes that order number from its file and fills in copy 1 to agree with copy 5. In addition, it fills in the method of shipment and the date shipped. In packing for shipment, copy 2 serves as the label and copy 1 as the packing list. If, however, the pattern is picked up by the foundry's truck, copy 2, the label, is destroyed and copy 1, delivery slip, is given to the driver, while the driver signs the delivery receipt, copy 5. In all cases, copy 5 is returned to the purchasing department after shipment has been made.

Operation 4 is performed by the purchasing department in conjunction with the purchase order and copies 3 and 5 of the pattern order. After operation 3C copy 5 is returned to purchasing. Purchasing removes copy 3 from its pending file (filed under purchase order number) and matches the two copies to determine whether a drawing was mailed or included with pattern. If engineering has decided a print is not necessary, it marks copy 3 accordingly. This check enables purchasing to determine whether all factors necessary to fill the order have been complied with, and therefore no delay will result because the foundry does not have patterns or necessary drawings. A notation on the purchase order that the pattern has been shipped completes the main cycle of operations.

Patterns returned. When patterns are returned, copy 4, which was filed in pattern-out file under operation 3A, is removed and placed in the pattern-in file, and the pattern is put into storage unless there is a slip in the awaiting-patterns file for it. If so, the pattern is reshipped on the new order.

In this article three files have been constantly referred to—pattern-in, pattern-out, and awaiting-pattern, all of which are kept in the pattern department. These files comprise the complete control of pattern storage, and tell at any instant the location of all patterns, and also of any patterns required to complete an order.

Awaiting-pattern file. This 3x5 file holds all the slips awaiting patterns that are either being constructed or are at other foundries being used. Also, it shows a complete backlog of pattern storage and is an indication of whether it would be economical to construct an additional pattern of the same part. This is particularly important if there happens to be more than one slip for the same part addressed to different foundries.

Pattern-out file. This 3x5 file holds all the slips covering patterns out of storage and at the various foundries. It is a complete inventory of patterns not on hand. It furnishes the dates shipped and shows the foundries at which they are located.

Pattern-in file. This is a transfer file. In it are kept all the slips for patterns that have been returned and placed in storage. Only the last slip for each pattern is retained. Therefore, the total of all the slips in this file, less those in the pattern-out file, should represent the entire pattern inventory, except for new patterns sent out for the first time. To offset this discrepancy, a slip is put in the pattern-in file to show that a new pattern was constructed on a specific date. This slip, therefore, makes the inventory complete.

Conserve Paper, Warns WPB

A critical shortage in the supply of lumber and plywood, warns the War Production Board, is again threatening the production of essential war materials.

Lumber is now in such critical short supply that a number of important military programs are seriously affected. Over-all lumber production has dropped steadily month by month since last August. The supply for the first quarter of 1945 is estimated to be approximately 18 percent below requirements.

Over-all pulpwood inventories in the United States dropped 12 percent from September through November. Much of the available wood pulp supply is now going for non-paper usage, and the requirements for such materials as military shipping containers and explosives are expanding rapidly.

What can you and your company do about it?

You can conserve paper. You can cooperate with the local paper salvage campaign.

Also, ask yourself this question every time you buy paper: *Can we save 25 percent of the paper on this job?* In most cases the saving can be made without half trying.

Checkers' stations in final inspection and packing department at Standard Register Company, where modern handling equipment enables women to handle a job that only husky men could manage

Mass Methods in Job Shop

CARL M. BORCHERS, Industrial Engineering Department, Standard Register Co., Dayton

A SERIOUS BOTTLENECK has been broken at Standard Register Company, Dayton, Ohio, through the application of mass production methods to a highly specialized job shop operation. As a direct result of the change-over, 19 women and 1 man are now handling a job that formerly defied the best efforts of 25 to 30 men. Changes involved the installation of mechanical handling equipment and the breakdown of a single operation, which only a husky man could manage, into a series of operations suited to women.

A Complex Operation

The bottleneck had developed in the final inspection and packing of the continuous business machine forms manufactured by this company.

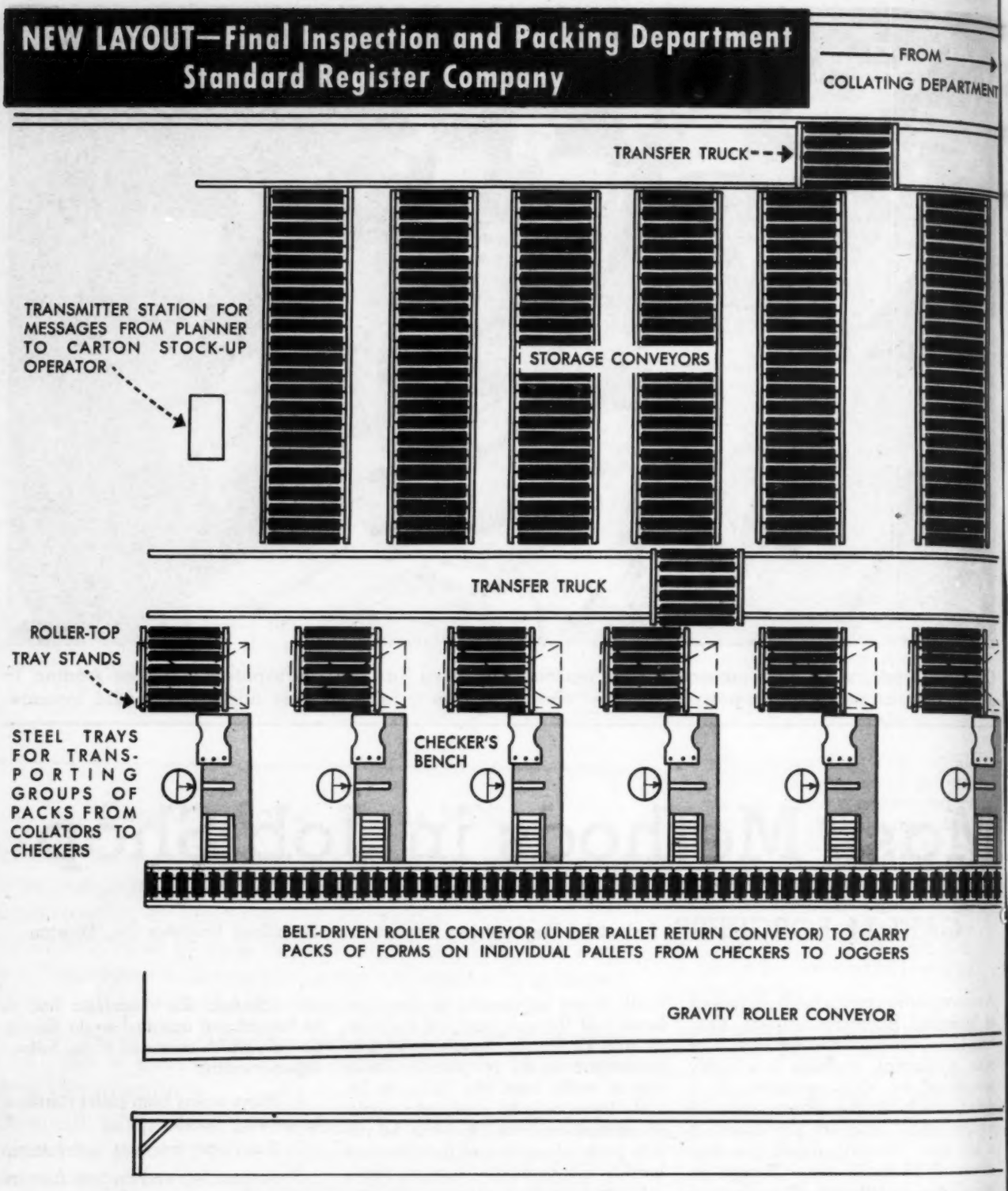
The method in effect was one of many years' standing. It seemed difficult, if not impossible, to change it because of the complexity of the overall job. Orders for hundreds of customers are always in process. Forms vary in width from 4 5/16 inches to 24. Also, forms may be made into single- or multiple-copy sets, and may be run into packs of any one of four standard heights. Consequently there are nearly 100 stock sizes of cartons, plus several hundred special sizes that must be made up as needed. Packs of forms weight up to 60 pounds, depending on size of sheet and height of pack.

Orders go to the packing department in comparatively small quantities; the completed order seldom goes to packing in its entirety, but is moved as the previous operation is completed, to avoid maintenance of unnecessarily large storage facilities.

It previously took 25 to 30 men packers to keep pace with the production schedule. Each operator had to be trained and qualified to do the entire job, which consisted of the following operations:

1. Move orders from pallet conveyor to packing bench.
2. Read and interpret instructions.
3. Inspect top and bottom form of each pack.
4. Straighten and align copies and carbons on a mechanical jogger.
5. Place pack in carton; stuff and seal carton.
6. Stencil carton.
7. Accumulate on large pallet and move to conveyor for delivery to the shipping department.

A part of the work required much skill, whereas other operations demanded considerable strength because


NEW LAYOUT—Final Inspection and Packing Department
Standard Register Company
FROM
COLLATING DEPARTMENT
TRANSFER TRUCK
TRANSMITTER STATION FOR MESSAGES FROM PLANNER TO CARTON STOCK-UP OPERATOR
STORAGE CONVEYORS
TRANSFER TRUCK
ROLLER-TOP TRAY STANDS
STEEL TRAYS FOR TRANSPORTING GROUPS OF PACKS FROM COLLATORS TO CHECKERS
CHECKER'S BENCH
BELT-DRIVEN ROLLER CONVEYOR (UNDER PALLET RETURN CONVEYOR) TO CARRY PACKS OF FORMS ON INDIVIDUAL PALLETS FROM CHECKERS TO JOGGERS
GRAVITY ROLLER CONVEYOR

of the bulk and unwieldiness of the packs. It was extremely difficult even for husky men to turn the packs over and at the same time hold the packs intact, but it was necessary to do so in order to avoid damage.

New Method

A thorough analysis was therefore made of several weeks' production, covering quantities, sizes, and other variables that affect the work. Flow charts were made up in complete detail and discussed by the industrial engineering staff, supervisors, and operators in order to determine which operations could be eliminated, which could be combined, and how the job could be improved.

Proposed flow charts were then worked out, with proposed layouts. Every element of operation was developed in accordance with work simplification principles. The equipment was set up on a small scale and tested, and the same people who made the suggested improvements were called in time and time again to analyze the proposed method—which resulted in further improvements and further elimination of production bugs.

The new method requires the same work to be done as before, but the work is broken down so that each operator does only a small part of the

ADVANTAGES OF NEW METHOD

1. A job once labeled "for men only" can now be handled by women

2. Operators become proficient in one-tenth the time required by the old method

3. Job calls for less skill, so a larger labor market can be drawn on

4. Production capacity has been greatly increased for same amount of floor space

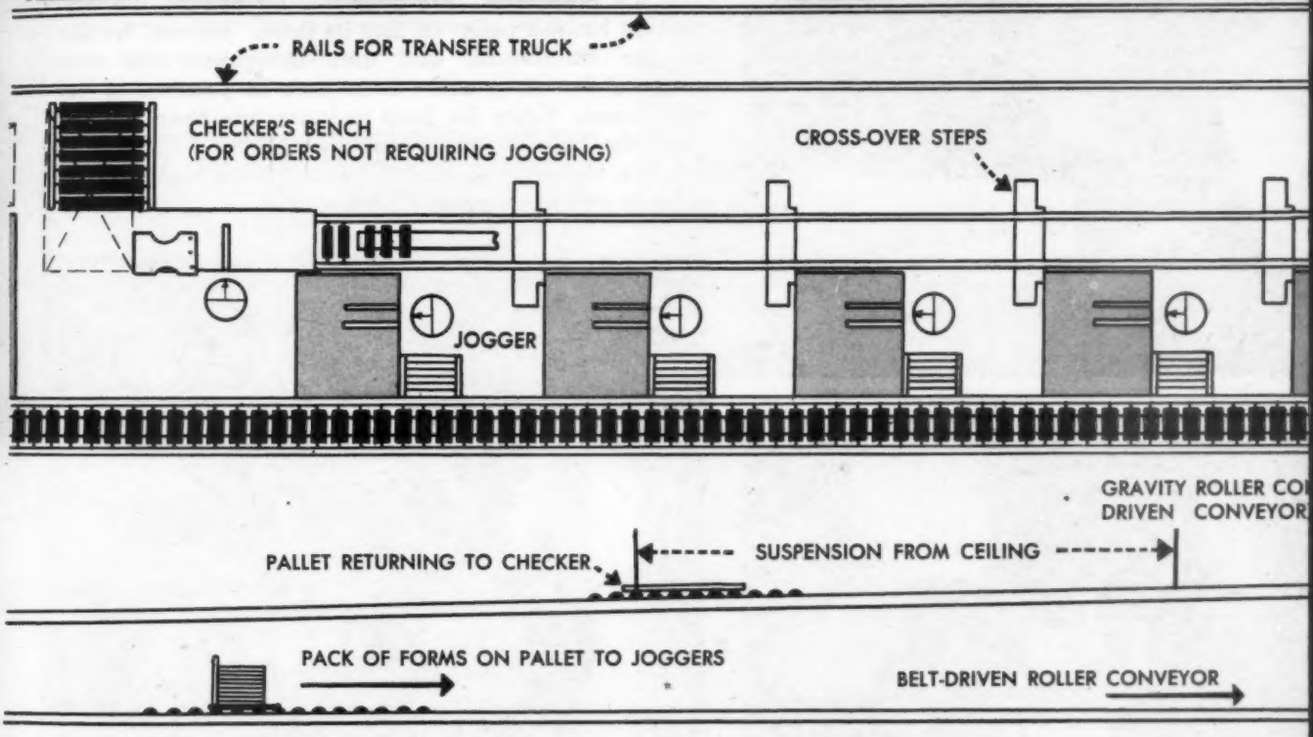
5. Fatigue has been minimized because operators never have to lift heavy packs

6. Better quality is assured because the women are, in effect, "specialists"

7. Paper tape for
tons is now saved

8. Time is saved
tions have been e

9. Line is more e
points to be servic



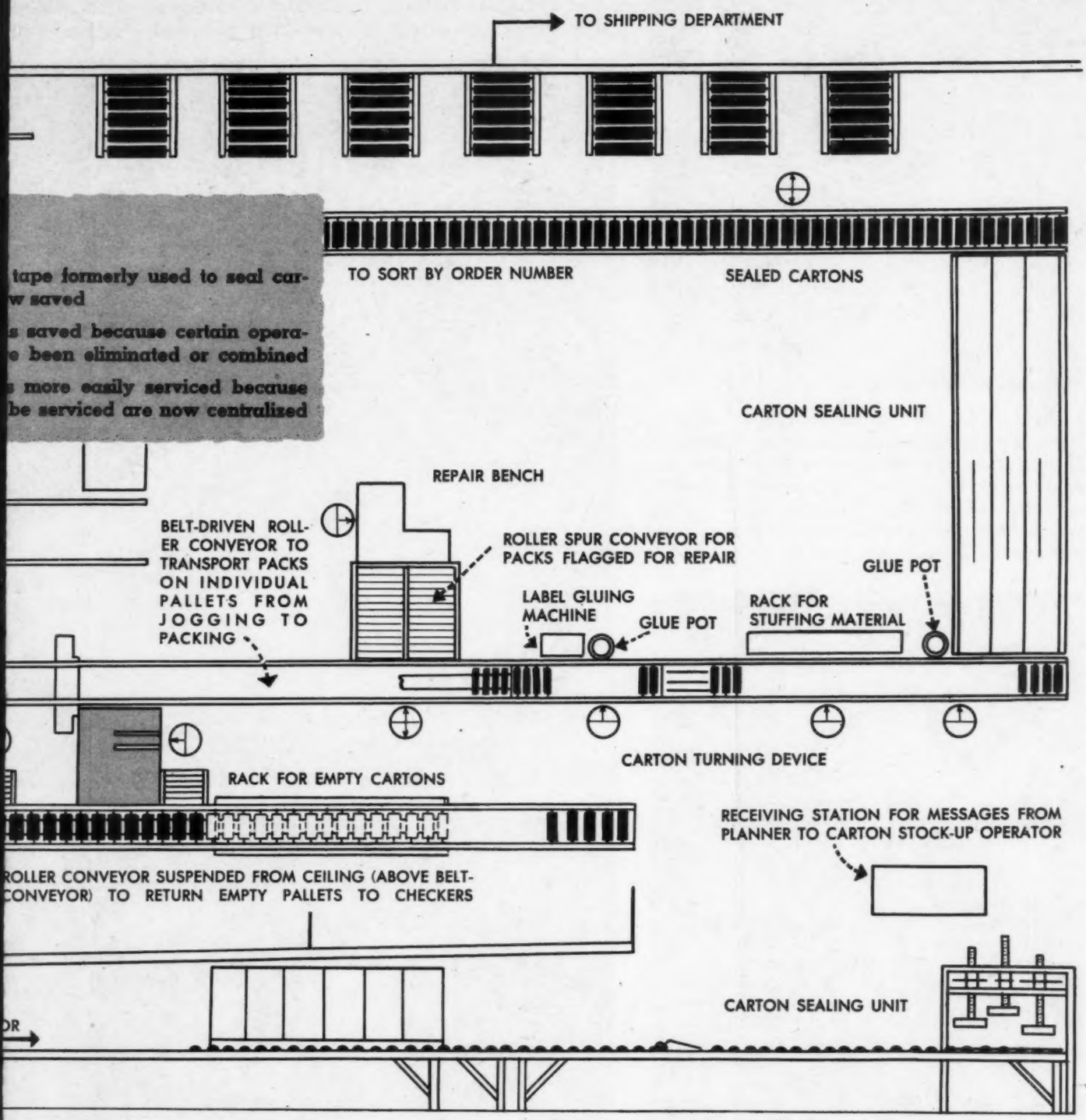
complete job. Production procedure now includes the following:

1. Orders (packs of forms on large tray) are moved from main conveyor to storage conveyors where they are grouped and work is planned. Orders as lined up by planner are dispatched to checkers on line, after which a written message is transmitted to carton stock-up operator, stating size and number of cartons needed.

2. Checker inspects each pack of forms, following a check list and customer's order requirements. Both top and bottom form are checked, so pack must be turned over. This is made easy by a finger-type turning device. After checking is completed, one-half of turning device serves as transport and handling pallet.

3. Pack, which has been properly identified, moves on transport pallet down belt-driven roller conveyor to jogging operation. Jogger slides pack into position, and jogs and straightens pack in order to align carbons with forms. After jogging, operator slides pallet with pack of forms to belt driven roller conveyor on other side of workplace.

4. Pack on pallet moves to carton selector, who glances at identification label to see which station pack started


TO SHIPPING DEPARTMENT
TO SORT BY ORDER NUMBER
SEALED CARTONS
CARTON SEALING UNIT
REPAIR BENCH
BELT-DRIVEN ROLLER CONVEYOR TO TRANSPORT PACKS ON INDIVIDUAL PALLETS FROM JOGGING TO PACKING
ROLLER SPUR CONVEYOR FOR PACKS FLAGGED FOR REPAIR
GLUE POT
LABEL GLUING MACHINE
GLUE POT
RACK FOR STUFFING MATERIAL
CARTON TURNING DEVICE
RACK FOR EMPTY CARTONS
RECEIVING STATION FOR MESSAGES FROM PLANNER TO CARTON STOCK-UP OPERATOR
ROLLER CONVEYOR SUSPENDED FROM CEILING (ABOVE BELT-CONVEYOR) TO RETURN EMPTY PALLETS TO CHECKERS
CARTON SEALING UNIT

tape formerly used to seal cartons saved

s saved because certain operations been eliminated or combined

s more easily serviced because be serviced are now centralized

onveyor to slides pack straightens rbons with rator slides s to belt- other side

to carton entification ack started

from, then grasps a carton from bin of same number. Carton is broken open and placed over pack. Pack, carton, and pallet move on.

5. Operator removes control ticket from pack in open carton, glues it to outside of carton, applies glue to inner flaps of bottom of carton. To avoid mix-up, carton ticket is not glued to carton until *after* carton is placed over pack.

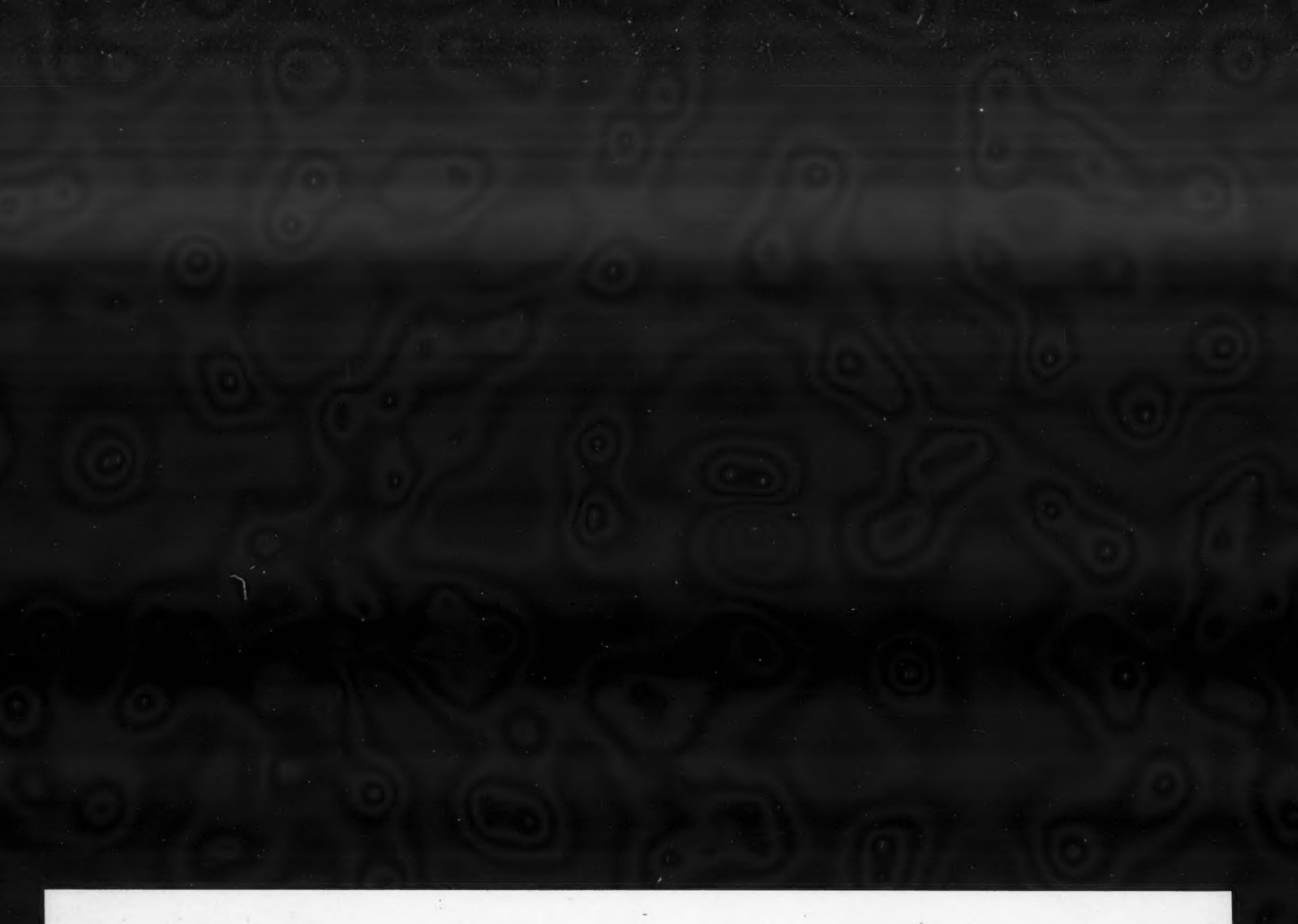
6. Operator closes outer flaps against glued inner flaps of bottom of carton, and rolls carton over, using roll-over turning device. Operator retains empty pallet and places it on return gravity roller conveyor which takes it back to checker.

7. Carton is now stuffed—filled up with scrap paper—by next operator in line and sent on to compression sealing unit.

8. At sealing unit, operator applies glue to inner flaps of top of carton, closes outer flaps against inner flaps, and moves carton into unit. Cartons feed through unit and out to gravity roller conveyor. (Paper sealing tape is no longer required, so company makes an important saving.)

9. Operator sorts sealed cartons on trays. When a tray is filled it is conveyed to shipping department.

CONTINUED ON BACK OF THIS SHEET



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1. Every time the planner moves a trayful of work to a checker's station he sends a message to the carton stock-up operator at the other end of the packing line, stating number of cartons and size needed. The right cartons are waiting when the packs of forms arrive a few minutes later at the cartoning station

2. Planner slides tray loaded with packs of forms from transfer truck to roller conveyor section at the left of a checker's station. Truck runs on track between storage conveyors and checker stations (see layout s ing the j Packs w and fro

4. Pack on pallet arrives at jogger's station via belt-driven roller conveyor at her left, stays on pallet during jogging operation. Here the operator has just finished straightening the pack and aligning carbons with forms, and is sliding the pack, still on pallet, to belt-driven conveyor at right of workplace. Behind the girl's head, the conveyor that returns pallets to checkers

5. Box selector slips carton over pack. She glances at label on top of pack to learn number of checker's station it came from, selects carton of right size from bin of same number in rack directly behind her. Bins are kept filled by carton stock-up operator who gets information from messages sent by planner at other end of inspection and packing line

out sketch on other side of sheet), thus facilitat- the job of keeping checkers supplied with work. ks weigh up to 60 pounds, but are never lifted from this time on travel on individual pallets

3. Checker has finished inspecting top form, must now turn the pack over. She does this by tipping the permanent hinged pallet so that its three "fingers" lie flat on her workbench, and then uprighting the two-fingered traveling pallet seen here in position at her right hand. When the pack of forms has been flopped over, the checker can inspect the bottom copy. Without this turn-over device, it would have been impossible to put women on this job

6. Control ticket which accompanies pack is glued to carton after latter has been slipped over pack. Here, operator closes outer flaps against glued inner flaps of carton and rolls carton over, using turn-over device set into roller conveyor

7. End of the packing line. Girl ahead stuffs carton with scrap paper. This girl applies glue to inner flaps of top of carton, closes outer flaps against inner, rolls carton into compression sealing unit. Cartons were formerly sealed with tape, so an important saving in material was made by incorporating sealing unit into line. Cartons from sealer are sorted to large trays which are moved to shipping department when filled

Counseling for Men by Men

KATHLEEN NORTH, Assistant Editor, *Factory*

With increased production demands, Arma Corporation, Brooklyn, N. Y., mushroomed to several times its pre-war size, thereby creating a need for the expansion of the scope of personnel activities conducted by the company. This need was met by designating a section of the personnel department as employee service for the handling of personnel relations. Into this group of contact men were fed all matters relative to follow-up and welfare of employees, personal problems, and minor grievances. Within a short time, because of the tremendous increase in the volume of items pertaining to women, a women's counseling service was inaugurated. With added men employees, the personnel employee service changed its name to men's counseling service, with the contact men becoming departmental counselors.

Departmental counselors are so-called because they do not have private offices where employees can come with their suggestions or problems. Instead, each is assigned to a specific plant area, which he tours systematically every day, so that anyone wanting to talk with him can do so without the red tape of making an appointment. All the men know their own counselor, they know he is friendly and interested, so they do not have the hesitancy in approaching him that they might have if it were necessary to consult a seldom-seen stranger behind closed doors.

Training Is Necessary

Arma stresses the fact that counselors cannot step into their jobs the first day and handle every problem that comes along. From two to three months are needed on the job before management feels that they are fully competent. During this training period they learn as much as possible about the men with whom they will be dealing, and the sort of questions they will have to dig down into the hat to find answers to. This is no little task. Each counselor has about 1000 employees in his territory, all of whom he tries to know by name.

First duty of a counselor is to make new employees feel at home. It is he who takes a newcomer in charge the first day, explains company policies, introduces him to his foreman, and helps him get acquainted with his fellow-workers. By so doing, the counselor knows employees in his territory right from the start.

Whatever is of current interest and concern to the workers comes within the bounds of their job. This they proved during the income tax scramble last March. One man spent two hard days in the Treasury Department learning all he could about the intricacies of income tax forms, and he also became acquainted with the right people, so that he knew just whom to call when a worker presented a nut too hard to crack. He helped anyone, regardless of territory, with his tax problems, made out the forms, figured deductions, solved knotty questions.

Again, during the fuel shortage last winter, the counselors turned to and helped solve the fuel problems. Although these are, in a sense, personal problems, personal advisorship of the counselors stops here. They admit

A counselor stops to answer a question. Informality and lack of red tape characterize Arma's counseling service. Each counselor has about 1000 men in his area, and he is expected to know all of them by name

that marital problems are well out of their territory.

Counselors fulfill a vital capacity in pinch-hitting for employees when affairs at home interfere with work. They have even been known to visit a school when a problem came up in connection with a worker's child. Time-consuming business details—correspondence, agency contacts—are handled by the counselors. Because of this cheerful pinch-hitting, worries are settled and absenteeism is lessened. Both employees and management benefit.

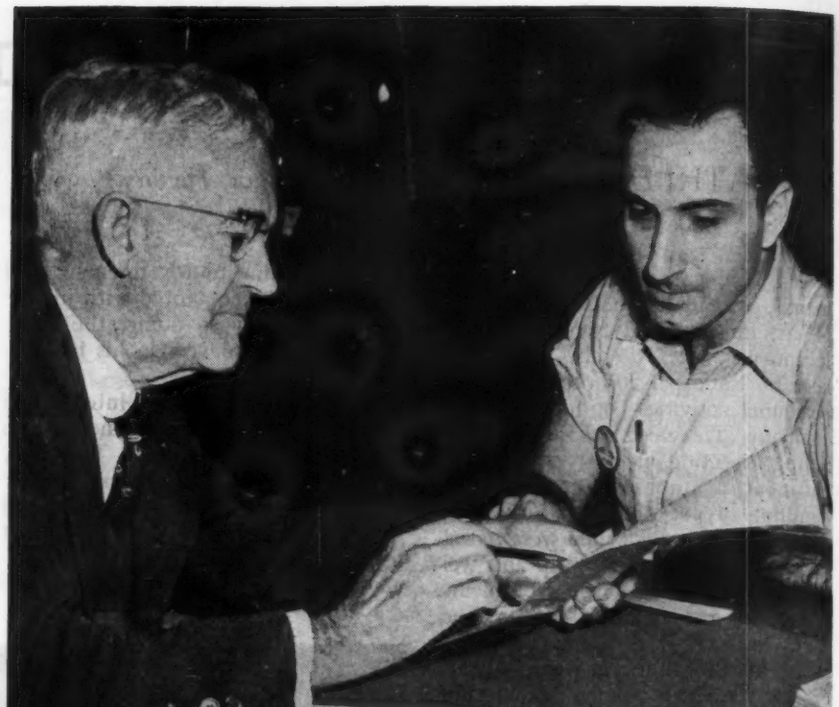
Another job that the counselors do is visit men who are ill or in the hospital. These calls are not "investigations"—there is a regular staff to check on people who may be willful absentees—but friendly calls, made by the counselor as a representative of "the boys in the shop." These visits are not only morale boosters, but make an unavoidably absent worker anxious to get back on the job as soon as he can.

One instance of close cooperation between men and women counselors is the matter of vacation plans. Questions that come up during the summer months are "Where shall I spend my vacation?" and "Where can I send my child to camp?" These are problems that men counselors refer to the women counselors who have literature about vacation spots, time tables, and rates. One of the women is always on hand during lunch periods, and a worker can take his lunch with him and munch on a sandwich while he looks over booklets. When he has made up his mind she writes for his reservations and plans his train or bus schedules for him.

In Charge of Food Wagons

The ever-present problem of providing food for thousands of hungry workers is under the direction of the supervisor of men counselors. It was found that a lot of confusion and time were saved if food came to the workers on the job. Twenty-four food wagons, six of which serve a complete hot blue-plate meal, are in operation, all of which start from the concessionaire's kitchen. Staggered lunch periods allow each cart to serve two territories. The system has proved so efficient that each territory is served in 12 minutes, leaving time to eat at a comfortable, healthful pace.

Milk and soft drink machines, accessible to everyone, ease the burden of the food cart operators. Supervising the maintenance and operation of machines by concessionaires is an additional duty of the men counselors.



One of the men counselors spent two days at the Treasury Department, learning all the ins and outs of income tax forms. He was then able to help any worker who found tax figuring too difficult

Occasionally counselors are in a position to discover a need that, without them, might not have been brought to management's attention. As a result, management sometimes sees fit to change company policy. For example, through the counselors' efforts, an arrangement was made with the American Express Company, so that personal money orders could be obtained right at the plant.

Workers are encouraged to settle their own problems whenever possible. But when personal gripes are brought to the counselors, they make every attempt to get to the root of the trouble, giving reasons for any particular action, and not giving up until they are sure the employee has a clear understanding of the facts.

None of the men hired as counselors came from the ranks of Arma employees, nor did any have previous personnel experience. School teaching, art, the ministry, and brokerage comprise in part the background for the roving counselor personnel. The men find that their varied backgrounds have been a definite asset. They are convinced that no amount of university training in personnel work will give them the knack of handling people that is acquired in business or a profession. They find that their different talents allow more cooperation among themselves. "What one of us can't solve, another can," said one of the men.

In choosing men counselors, Arma stresses disposition and personality rather than formal education for, and experience in, employee relations. Management at Arma believes that a good counselor must be more interested in other people than in himself. He must get more of a kick from accomplishment on the job than from personal gain. He must be impartial enough to see both the side of the foreman and the side of the production-line worker. And he must have a strong sense of equality, never to conduct himself in the manner of a principal interviewing a schoolboy.

These counselor qualities have proved themselves, for since the inauguration of the plan only one man chosen has not lasted in his job. That men counselors have succeeded in winning the confidence of their fellow-employees is made evident by the workers themselves, who readily come to counselors for help with matters they would muddle through rather than put up to anyone else. That they have won the confidence of management is seen by the ready admission that men counselors are a fixed institution at Arma, with every expectation of continuing as a post-war policy.

Safety Training for Shop Truck Drivers

GLEN B. LOCKWOOD, Safety Director, The White Motor Company, Cleveland

A TRAINING PROGRAM for shop truck drivers at the White Motor Company, Cleveland, is largely responsible for a record of 14 months in which there has not been a single materials handling accident in this company's 47-acre plant. In addition, the program has contributed importantly to the general efficiency of the drivers, and in turn to the whole establishment where more than 5000 employees are engaged in war work.

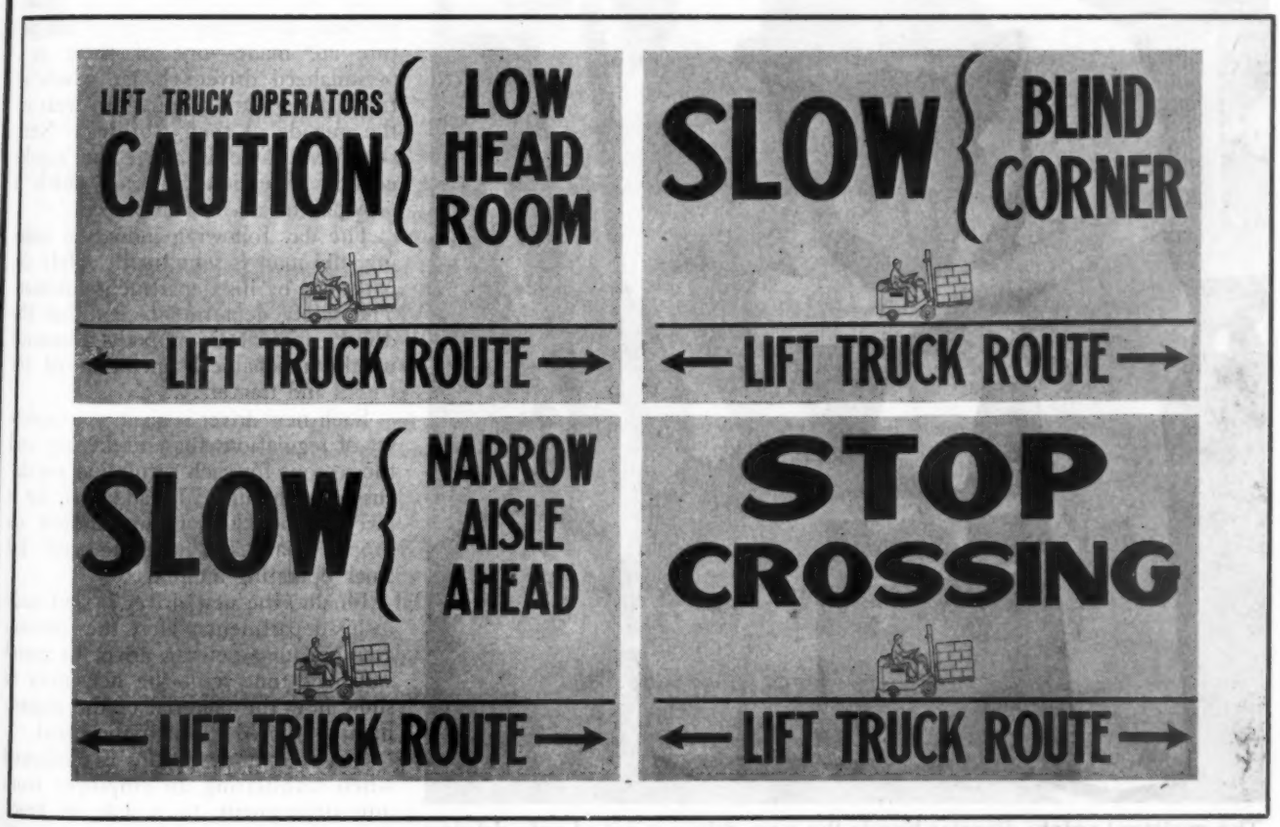
Inside the buildings of this company and on its grounds there are approximately 75 mechanically powered, shop-size trucks in constant service—pushing, pulling, and lifting materials. The trucks and their drivers are located in the various departments according to need, but they also roam about on call in shop and yard. Naturally, the receiving and shipping departments have the major materials handling job to do, and they have the largest number of the trucks, 23 and 31, respectively. But in every department and yard the trucks are used to carry supplies and parts to points of need on the production lines, to keep the aisles free of scrap and waste, to shift subassemblies to new stations, and otherwise to see that a normal flow of production is maintained.

Trucks Have Big Job

From the incoming trucks and freight cars they carry away the needed supplies, and stack or store them where they are needed. As the processing in one department is completed, the trucks are on hand to haul the parts to the next, and so on through the manufacturing cycle. Hold-ups for lack of transportation are rare because of a schedule that anticipates requirements. Routing is entirely flexible to meet all demands.

A large percentage of the shop trucks that are used at White are fork lift vehicles which have been found especially well adapted to this company's production and safety programs. They are kept as busy as bees on manifold errands, loading and unloading, transporting and stacking, making certain that every machine and assembly line is well fed, and that shipments are properly handled.

Today in this plant scarcely any-



Traffic signs, 14x22 inches, with large black letters on a bright yellow background, have done their part in helping to achieve a long period of accident-free materials handling at White Motor Company

Foreman of a department where a prospective driver has been assigned sends the new man to the safety department for his general instructions in truck operation and a detailed explanation of safety rules

The assistant safety director hands the new driver a set of safe driving regulations. Later the reason for each rule is discussed in detail to make sure its importance is realized by the driver

thing is set down without provision for a ready pick-up. Skids, pallets, racks, dollies, boxes, platforms, and trailers make it possible for the trucks to lift or pull away a load without delay. Some accessories especially made for handling axles, engines, or other bulky or heavy parts also have been provided to facilitate the system.

With this general picture of White's plant materials handling operations in mind, it is easy to see that this company had a major safety problem to be solved because of the great volume of individual handling tasks and the variety of materials to be handled. The driver training program was put in operation in January, 1944, and began to show the results desired of it almost immediately.

It begins with a rule not to hire as drivers anyone under 21 years of age. Then, when a man is hired to be a driver, the personnel department informs the safety department, which makes the necessary investigation of his qualifications. This is done before the employee is taken through the regular induction procedure of photographing, fingerprinting, and similar details.

Drivers Know "Why"

If the employee's qualifications for driver are satisfactory, he is photographed, and three copies of his picture are made—one of them as a personalized driver's badge which all truck drivers are required to wear on the outside of their clothing. Next, the driver-to-be is given the regular general induction training which is provided for all new employees.

The day following induction training, the man is sent to the safety department by his department foreman. The safety department sees that the driver candidate is properly instructed in the mechanical operation of lift trucks and tractors.

Each new driver is given a complete set of regulations for safe driving, and the reasons for each regulation are discussed with him. In addition, he is given a booklet of information on proper materials handling and lift truck operating methods.

Finally, the new driver is sent back to his department. Here the foreman arranges for a veteran driver to spend sufficient time with the new man to show how the material of the department is routed through the plant.

This same procedure is followed when transferring an employee from any department to a job as truck driver. It also applies to alternate drivers who hold other jobs but who are called upon for truck operations in

event of the absence of a regular driver. In other words, no one can become a truck driver in the White plant without first having gone through the complete driver training program.

Safety measures do not stop, however, with the completion of the training. To aid materials handling safety and efficiency, special care is taken in all departments to keep aisles and corridors clear in order that traffic may proceed free from unnecessary obstacles or barriers. A top speed limit of 7 miles an hour is enforced, and no movement of trucks is permitted in the corridors of the plant during the lunch hour.

Special emphasis is placed upon the necessity for drivers to take extra caution at corners, crossings, in narrow aisles, and in locations where the headroom is low. All these places are clearly marked by large traffic signs to serve as reminders to the drivers of

Rules and regulations are explained to every driver at White. Obeying the rules has kept the plant free from materials handling accidents for the past 14 months

Individual instruction in the actual operation of a fork lift truck is given to the new driver by a trainer in the safety department

Rules and Regulations for Fork Truck and Tractor Driver

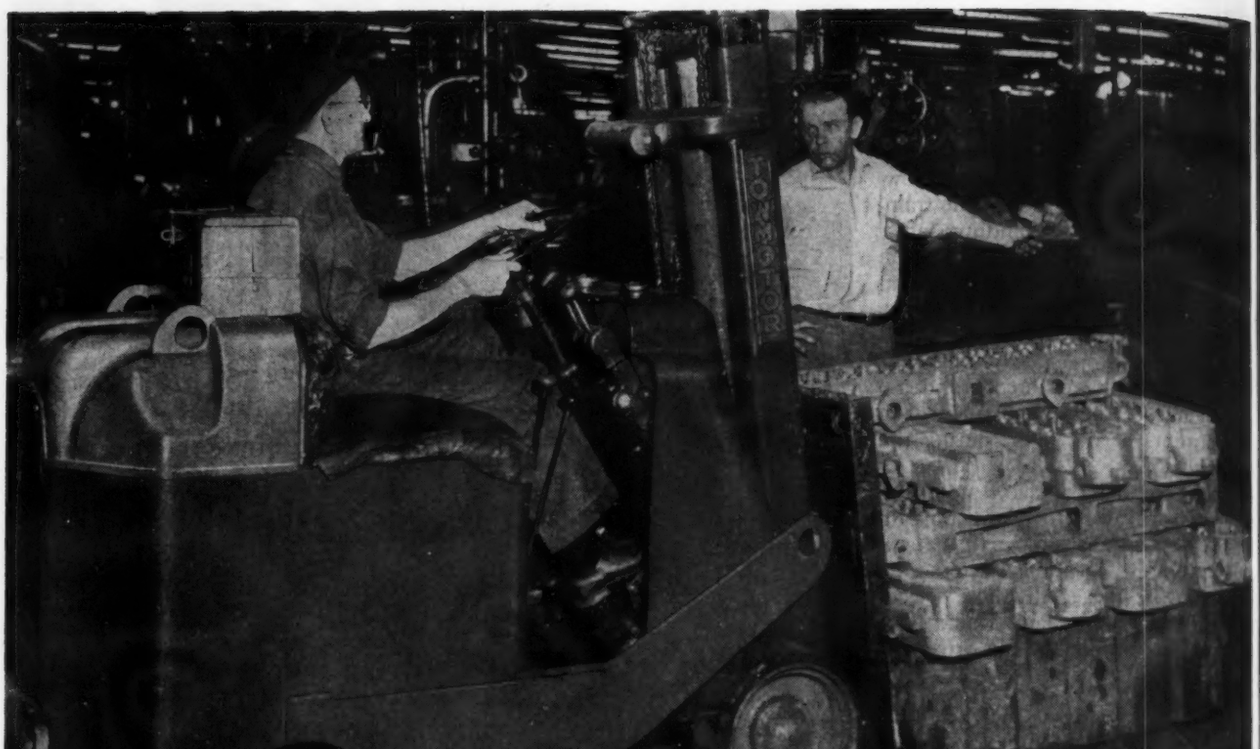
1. **Safe operation of truck**
   - A. Be sure motor is not running while filling tank with gas
   - B. Be sure truck is equipped with fire extinguisher and that you know how to use it
   - C. Check your brakes every day

2. **Safe driving practices**
   - A. Our speed limit is 7 miles per hour. You will be required to obey it
   - B. Wherever possible stay out away from all corridor entrances where people may accidently step out into your path
   - C. Be sure all trailers are hooked properly
   - D. At quitting time and lunch time, tractors or trucks are not permitted to move in the corridor
   - E. Riders are not allowed at any time

3. **Safe loading of trucks**
   - A. Don't overload your truck
   - B. Be sure all material on your truck is securely loaded and when necessary fastened down
   - C. Use caution when turning corners

4. **Safety in unloading trucks**
   - A. Whenever possible, consult department foreman as to the place for unloading your material
   - B. The aisles and corridors must be kept clear for safe traffic
   - C. Do not block fire doors

Safety Department



Back in his own department, the new driver gets final training from an experienced hand. This training includes teaching proper routes to follow in delivering materials in shop and yards

proper procedures previously taught in the training program.

Last, a continuous campaign to stress the importance of safety and proper materials handling in general is maintained, partly through the display of cartoons which emphasize the various safety rules and help the drivers to remember them by making clear the good reasons that lie behind the required obedience.

Know Their Way Around

Once the White drivers become accustomed to their trucks and to the shop routes, they become highly adept in handling materials, moving in congested areas, and in turning around "on a dime." For them the plant becomes a miniature city—with main thoroughfares, stop streets, caution points, and with a code of regulations by which they must abide to protect themselves and their fellow workers.

The safety and efficiency record of White's drivers, several of whom have been on the job from 10 to 20 years, well indicates in the past 14 months the beneficial effects of a carefully planned system of driver training, coordinated with proper control of routing of materials. White believes any company could benefit from adoption of a similar system.

SAFETY FIRST
The responsibility for the safe operation of the elevator will be placed on the operator who will:
1. Signal all shop trucks when to enter or leave the elevator
2. Make absolutely certain before starting elevator that all approaching traffic has come to a complete stop
3. Exert judgment as to weight or capacity of load—the operator's decision being final
4. Make certain that the way is clear when discharging shop trucks
5. Report to his supervisor any and all damage that may occur to the elevator
Safety Department

When trucks ride elevator platforms, a supplementary set of safety rules apply. These regulations are posted in all freight elevators, and elevator operators are held responsible for strict observance

Standard Time Data Mean Quick Rates on New Jobs

DANIEL H. SPOFFORD, Assistant Factory Manager, The Wiremold Co., Hartford, Conn.

STANDARD TIME DATA are used at The Wiremold Company, Hartford, Conn., to set rates and figure incentive wages for employees on new jobs when there has been no opportunity to set up specific time allowances for them.

All that is necessary to reckon the synthetic totals is a master table of time values for individual elements of standard jobs. Thus, when a new job is set up that does not duplicate in all details some other job for which the standard time has already been figured, it is not difficult to list the various elements in the new job and to apply figures taken from the master table.

The combined total of all the elements in the new job then serves temporarily as its rating. It has been found to be a procedure applicable to 90 percent of new jobs and to work fairly for employees and company.

Most of the work at Wiremold is done on punch presses, used for blanking and forming electrical fittings as well as for various products that are finished for war use. The plant has been operating on three shifts with new job processes being set up with abnormal frequency.

Master Table Prepared

In order to compensate workers on these jobs on a basis comparable to other workers who are on incentives the master table of standards was prepared. It covers such operations as: Draw, blank, form, indent, twistout, hammerback, bead, curl, holecut, pierce, fold, and knockout. Time values were taken from time studies and motion time analysis.

A typical application of this system is the case of Operation No. 10, a twistout each side with two strokes of the press. In this operation it was determined that the nine elements were: 1c, 2b, 3a, 3xb, 2b, 3a, 4a, 6b, and 6c. Times allotted them in the master table totaled 0.101 minute.

Applying a 20 percent incentive rate, the standard for this job becomes: $0.101 \times 1.20 = 0.1212$ minute per piece, and $60/0.1212 = 495$ pieces per hour, or 0:202 earned hour per 100 pieces.

STANDARD TIME DATA

Press Department
(One Stroke per Piece)

	Time in minutes
1. Get blank or fitting from supply box at left of press and	
a. Place in nest of die	0.015
b. Locate over pins in die	0.025
c. Locate at right angle to die	0.020
2. Trip air valves	
a. Trip 2 air valves (40" max. across valves)	0.020
b. Trip foot air valve	0.010
3. Wait for ram to complete stroke	
a. 100 r.p.m. and over	0.010
b. 65 r.p.m.	0.015
c. 37 r.p.m.	0.030
3X. Two or more strokes per piece	
a. Turn piece 90 degrees	0.010
b. Turn piece 180 degrees	0.015
4. Remove formed piece from die and dispose in box at right	
a. Flat bed	0.020
b. Tilted bed	0.025
Remove formed piece from die and dispose down chute	
c. Flat bed	0.015
d. Tilted bed	0.010
Formed die disposed automatically down chute	0.000
5. Remove totebox from rear of press and replace with empty box	
Actual time	0.800
Allowed time per piece—a. 50 pieces per box	0.016
—b. 100	0.008
—c. 200	0.004
—d. 400	0.002
—e. 800 and over	0.001
6. Remove empty supply box at left of press and replace with full one	
Actual time	0.400
Allowed time per piece—a. 50 pieces per box	0.008
—b. 100	0.004
—c. 200	0.002
—d. 400 and over	0.001

Master table of standard time data for press operations provides information from which synthetic times can be built up on new jobs

How an Incentive Plan Offset a Manpower Loss

H. L. HAINES, Factory Manager, Economy Baler Company, Ann Arbor, Mich.

IN THE MONTHS prior to August, 1943, the normal complement of 150 to 175 productive workers at Economy Baler Company, Ann Arbor, Mich., dwindled, because of the rate freeze and the higher rates obtainable in nearby war industries. In fact, about 48 percent of the productive force was lost. This became a serious impediment to delivery of balers for synthetic rubber, clothing for overseas shipment, scrap, and a host of other war uses.

The only solution to this situation seemed to be an opportunity for productive workers to earn more, and hence halt the march away from the plant. Obviously, any plan adopted had to conform to WLB regulations of increased output and no increase in cost. After two or three false starts, a plan was accepted which currently is yielding an over-all plant increase in production of 34 percent. On machine jobs, the increase is 15 to 20 percent, because of the limitations of the machines; but in baler assembly, which is all manual, the increase is about 60 percent. In other words, the time taken to do the jobs has been reduced by these percentages. The plan, therefore, has gone a long way to make up for loss of workers. And it has halted the quits, because it is obvious to workers that they can earn as much where they are as in other plants.

Before describing the details of the plan, some familiarity with the character of the work performed is essential. Baling presses are hand or power operated. The former run from 150 to 3000 pounds in weight; the latter, from 3000 to 20,000 pounds. Processing of structural steel, machining of shafts, casting, riveting, painting, welding, assembly, and crating make up a total of some 25,000 different operations. Of this total, standard times have been set on more than 4000 jobs—the most frequently recurring jobs, of course, were studied first.

The plan is an individual one. It might be called a 100 percent time premium plan. A task time is determined by time study for the job; if the worker takes less time, he is still paid for the task standard. For example, if the standard time on a job is 6 hours, and the operator does it in 4 hours, he is paid for 6 hours. Suppose, further, that the measured time on his next job is 2 hours and the working time 1 hour, the operator is paid for 8 hours, although his actual working time is 5 hours.

Typical Examples of Time Saved Since Installation of Incentive Plan

Operation No.	Former Man-Hour time	Time study time	Actual time
#37 assembly, mechanism	2.00 hours	0.91 hours	0.78 hours
#13 assembly, door	0.40 "	0.22 "	0.17 "
#12 assembly, chamber	2.88 "	1.32 "	0.85 "

Figuring Overtime

Overtime had to be incorporated in the plan, because the plant operates 53 hours a week. To illustrate how this is done, the above illustration may be extended. The operator has worked 5 clock hours on two jobs with a combined standard allowance of 8 hours. He is paid for 8 hours. Assume now that the next job has a standard time of 3 hours and that it requires 3 clock hours for the operator to finish it. He has worked 8 actual clock hours (4 + 1 + 3), but is credited with 11 hours (6 + 2 + 3) of standard time. Since time and a half is paid for all hours over 8, he is paid his regular hourly rate for 8 hours and time and a half for 3 hours—a total of 12½ hours for the day. If an operator worked the regular 53-hour week and completed jobs whose standard time totaled 60 hours, he would be paid time and one-half for time over 40 hours—or for 20 hours.

The standard time may, and does, vary from 0.01 hour for a machining operation to 1500 hours for a large press assembly. A method, therefore, had to be devised for jobs continuing from day to day. Each day the man is paid time and a half for all clock hours over 8. For example, if he works 10 hours, he is paid for the excess 2 hours at time and a half, or a total of 11 hours at his regular rate (8 + [2 × 1.5]). When the long job is completed, the operator is paid the difference between the standard hours and the clock hours spent on the job. If, for example, the job was timed at 80 hours and he worked 60 hours, he would be paid for 80 hours—the overtime being credited each day plays no part in the final accounting. This is a feature of great importance, because jobs frequently run over three weeks, and one operator may run more than one job at a time. This is a common occurrence in erection or assembly, where a mechanism assembler may be able to complete his part on a particular press only after riveters or welders have performed their operations—he, therefore, has more than one baler in a partial state of completion.

It was stated before that the plan was an individual one. Under the old straight-time method of operation, groups in erection were frequent. A group leader might have two helpers. In setting the time on erection of the large power balers, 10 hours, let us say, was considered to be the proper helper allowance. Helper time rates are 75 percent of erectors' rates. Therefore 7½ hours are added to the

PART NO. 15232 DESCRIPTION C.I.

BALERS USED ON #145 NAME Worm Housing

Operation No. / Quantity	DESCRIPTION OF OPERATION	PAY TIME
255	Set up to drill, in jig, ten 25/64" holes, ten 17/32" holes & one 15/16" hole - Machine #14	.18
256	Drill in jig	
1 piece	Machine #14	.20
257	Set up and tap ten 5/8" holes & one 3/4" pipe tap by hand, put	
1 piece	in rack Machine #14	.14
1085	Set up to mill bottom - Run one	
	Machine #22	1.93
1086	Mill bottom	
1 piece	Machine #22	.96
1087	Set up to bore and mill end - Run one	
	Machine #21	2.51
1088	Bore and mill end	
1 piece	Machine #21	1.13
1089	Set up to mill to length - Run one	
	Machine #22	.64

Figure 1. Operating data, including standard or "pay" times, for machining operations are entered on the outside of an envelope that contains blueprints of the part

had to be consulted; now the part is used as is and the unnecessary time-consuming discussions are eliminated.

To be successful, the plan not only had to enable higher worker earnings, at no increase in cost, but it had to be simple to operate. Manpower was not available to administer a complicated plan; then, too, a complicated plan would surely be discarded at the first drop in sales volume. One time study man and a woman helper carry on the rate setting and time computations involved in the payroll.

The standard time allowances from time study are entered, for fabrication on machining operations, on the outside of an envelope containing the blueprint of the part (Figure 1). The operating information on the outside of the envelope is rubber-stamped on the back of the blueprint. The envelope is a permanent production office record, while the blueprints are assembled for a complete manufacturing order for the shop. As jobs are assigned

time allowance for the erection, which the erector may or may not use, but he is paid for these hours at his rate. Experience has shown that, after the first assembly under the new plan, little of this helper allowance is used, another manpower saving of no little importance. For example, the standard allowance on the erection of one type of baler is as follows:

Get out stock..... 7.00 hours
Build baler.....75.00 hours
Helper allowance.. 7.50 hours

Total .....89.50 hours

The builder, or assembler, is paid 89.50 hours for the job if he uses no helper labor—and, in general, he uses little of it. Under the old plan, conferences between helper and leader were frequent, measurements had to be made, correct hole location had to be considered, and often the foreman

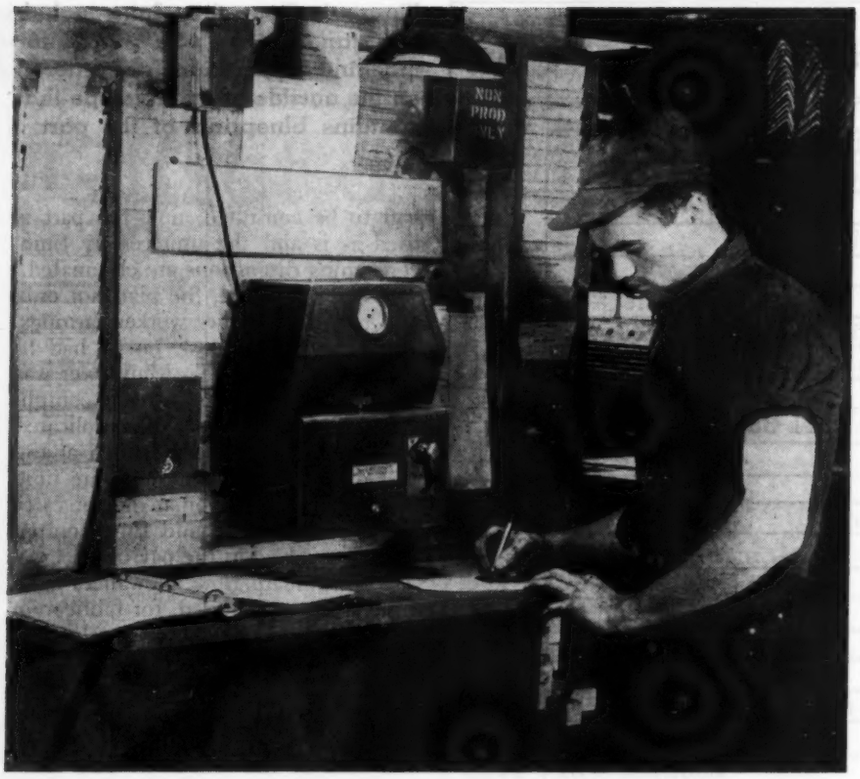
Figure 2. Time card is turned in daily by each worker. "Total time" is obtained by multiplying quantity produced by standard allowance, or "pay time." Note that 10 hours were worked, but 12.75 were earned

COST TIME CARD

CLOCK NO. 69 DATE 11-19-1944

NAME John Doe

Quantity	Job Order or Part No.	Operation Number	Pay Time	Total Time	Actual Time	Start Stop
23	15232	256	.20	460	356	6.45
						10.06
25	15232	257	.14	350	230	10.06
						12.86
1	18851	Drill		26	26	12.86
						1.12
10	5610	1456	.04	40	33	1.12
	5611					1.45
1	5563	1358	.08	~~.08~~	09	1.45
				09		1.54
96	5563	1359	.015	144	100	1.54
	1A227					2.54
80	18165	Drill		166	166	2.54
	1A430					4.20
Clean machine #			109	80	80	4.20
						5.00
OK			TOTAL TIME		12.75	Pd



Assembly worker figures out his time card. Rate book placed near the time clock contains allowed times for all the assembly operations

to the operators by the foreman, the standard time allowance is available to the workman from the back of the print. In the case of assemblers, rate books are prepared and placed at time clocks in the shop. A space is provided for each type of baler to be assembled, and the standard time allowances are entered as groups. One grouping would cover structural assembly, another riveting the chamber, another assemble mechanism, and so forth.

The time allowance on studied jobs is thus freely available to workers before the job is begun. The time office has a copy of the time allowance also. When a manufacturing order is released to the shop, the stockroom is given a list of the parts required for the order, and a copy of this parts list also is in the time office. The reporting of parts completed and the time is done by the operator, and his daily time card is signed by the foreman (Figure 2). If checking is necessary, information is available in the time office for verification. With some 80 operators, it soon becomes evident whose cards need to be checked completely every day and whose need to be checked only occasionally.

To make the coverage in the shop as complete as possible, indirect labor of toolmakers, stock handlers, sweepers, and supervisors had to be considered. These men are given a bonus equivalent to the percentage of premium hours earned by the productive workers. For example, if during one pay week productive workers completed jobs whose total standard hours totaled 5500 in 5000 actual clock working hours, the ratio is 10 percent, $(5500 - 5000) \div 5000$. Weekly earnings of indirect workers are increased by this 10 percent. Early in the operation of the plan, before a great many jobs were on standard time, the percentage earned by productive workers during one week was 3.4 percent. An indirect worker working the 53 hours would be credited with 1.75 additional hours, or a total of 54.75. All hours above 40 would, of course, be paid for at time and a half.

The results of this plan have been eminently satisfactory. Worker acceptance in general; and, if jobs upon which standard times have been set are considered, the bonus, or premium hours added now run at 28 percent. The 4176 timed jobs out of the current 25,000 jobs may seem small, but they are the most frequently recurring ones, and more jobs are being studied all the time. Eventually all jobs that are run every two or three months will be covered. Workers do not object to working upon jobs still on a straight time rate, but requests for a time study on such jobs are frequent.

Worker Knows Earnings

Certainly an important ingredient in worker acceptance of the plan is the fact that he can calculate his earnings each day; he knows the time allowance on studied jobs before he begins them; and he can calculate his earnings on a long job as readily as the time office. If his job lasts for 1000 hours, he is paid his guaranteed rate each week for 59.5 hours $(40 + [53 - 40 \times 1.5])$; and at the end of the job he is paid the standard time for that job if he saves time on it—if not, then for the actual hours worked.

Inadequate scheduling did not account for the 34 percent reduction in time lost. Idle and unnecessary time squeezed out can be given the credit. Incidentally, soft drink sales decreased 50 percent after the inauguration of the plan. Absenteeism has been cut down markedly, because too much money would be lost through absence.

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Quick Action Encourages Workers' Suggestions

V. O. WILL, Director of Personnel, Elliott Company, Jeannette, Pa.

IT IS UNUSUAL for a company employing no more than 4000 persons to receive, as a result of its suggestion award campaign, an average of 25 employee suggestions *daily*. Elliott Company, Jeannette, Pa., has achieved that result, and the awards for employee suggestions easily top all other activities in general interest. During the first 6 months of operation of the suggestion system, 782 suggestions were received, and 228 were accepted. The awards on suggestions ranged from $2.50 to $200. A total of $2580 was paid to employees for their ideas during these first six months.

"Repeaters" are far from unusual in the Elliott Company suggestion plan. Ross Curry won seven times in one month, here demonstrates his idea for an improved grinding operation on a turbine diaphragm

Why System Succeeds

The success of the Elliott suggestion system is attributed to two things: First, this company is genuinely anxious to receive employee suggestions for the improvement of production and the lowering of costs, is more than willing to pay for them and to use them. Suggestions that are worthy of award are not only recognized substantially, but also are promptly installed. This company believes that the originator of an idea is not satisfied merely to receive cash recognition; he also wants to see his brain child put to work.

The second factor in the success is the committee mustered from among executives and union members to process the ideas submitted. Nothing depreciates a suggestion system more rapidly than judges in whom employees lack confidence. Here a top-flight group has been assembled within the organization to pass upon employee suggestions. Management representatives are keymen from the administrative and production departments; and union representation on the committee is equally able. These people attend two meetings a week, during which every employee suggestion is considered and passed upon as soon after it has been handed in as possible.

The chairman of the suggestion award committee is engineering assistant to the president. The chief manufacturing engineer of the company further bulwarks the technical side of the committee. An officer of the shop union shares the labor representation with a member of the office union. Finally, there is a full-time suggestion award committee representative whose duty it is to investigate personally every idea upon which the committee is unable to agree.

The time of these men, in view of their key positions, might at first glance seem to be over-occupied by employee suggestions. In fact, however, results demonstrate that their attention could scarcely be used to better advantage. Elliott Company has definitely benefited, technically and productionwise, by the solid thinking of the skilled craftsmen who run the machines. The committee has made it a practice to reward every idea adopted on the basis of 10 percent of estimated savings for the first year. In a surprising number of cases it has been practical to evaluate those savings in definite terms and at once. In only one case has it been necessary to revise a suggestion award, and in that instance the revision was upward; initial payment to the employee who thought of the idea was doubled.

It is Elliott Company practice to acknowledge every suggestion as soon as it is received. This is done in the form of a card addressed to the employee at his work station, informing him that his idea is at hand and will receive consideration as soon as pos-

How Elliott Company Handles Employee Suggestions

1. Suggestion forms are distributed throughout the shop and offices in the boxes provided for them.

2. Suggester secures one of these forms and writes on it, in his own way, the idea he wishes to submit.

3. Form, with the employee's suggestion, is either mailed to the suggestion committee office or put back in the box to be picked up by the investigator on his daily rounds of the plant.

4. Original suggestion is acknowledged immediately upon receipt, then it is copied on an investigation form, which is sent to the person most familiar with the subject matter, for his recommendation.

5. When the investigation form is returned, with a recommendation, the investigator checks to see if there is any further information available on the condition that exists, or the results that may be obtained by a change. This step is taken so that a more complete picture of the proposal may be presented to the committee when it convenes.

6. Typist makes nine carbon copies of the suggestion for the review of the members of the committee.

7. Suggestions are brought up at the meeting in the closest possible numerical order for the convenience of filing, but at the same time the sequence of the dates of submission is kept.

8. Committee members discuss the suggestion, and each gives whatever information he has about the particular conditions.

9. Decision is made on the suggestion and an award is arrived at—either by the figures of the evaluation or, if the suggestion's merits are intangible, an estimate of the value of the proposal to the company.

10. Decision is posted in the minutes of the meeting of that day. From these minutes are compiled the suggestion award list, rejection notices, and the letters that are sent to department heads, advising them that a suggestion involving their department has been accepted, and requesting them to order the new equipment and start the new procedure.

11. Follow-through and replies as to the adoption and application of the suggestions are required of all department heads responsible for putting suggestions into effect.

sible. The suggestion—which is thereafter identified only by a number—is then copied for each member of the committee. A copy is also referred to the department head and the foreman concerned. By the time the committee meets to pass on the suggestion, each committee member has had time to read over the description of the idea; and opinions have been received from the department affected as well.

It often happens that the committee, in considering an idea in open meeting, finds cause for disagreement with the foreman or department head reporting on the suggestion. The committee representative has 12 to 15 such debatable ideas per week to investigate personally, and it is his job to determine the true value of the ideas regardless of the objections of foremen or others. Naturally, a great deal of diplomacy is involved in this phase. Originally, resistance from foremen and department heads was expected. Some of them felt any suggestion for improvement might be a reflection on their own capabilities. However, supervision has been convinced by actual example that a new idea or an improvement in operations is a credit to the department concerned, rather than a reflection on anyone.

Once an idea has received an award it is the practice to instruct the department affected, in writing, to install the new procedure at once. Authority is given to order the equipment or materials needed to put the idea into effect, and a written notice that this has been done is expected from the head of the department. This procedure is not allowed to drag, and a follow-up file insures that action is taken promptly.

Not all employee suggestions, of course, are practical or adaptable, and it is necessary to reject some 75 percent of the ideas submitted. Here, again, this company believes in individual treatment. The originator of any unacceptable idea receives a written explanation as to why it was not adopted. The man often does not agree with these reasons and feels that arguments of value have been overlooked in making the decision. In this case the committee's representative gets in touch with employee in person and while presenting, on behalf of the committee, the objections to the idea, gives him every opportunity to present his counterarguments.

Handling Duplications

Oftentimes, by the coincidence that is not uncommon in manufacturing development, two men will think of the same idea at approximately the same time, or an idea will arise from discussion in which more than one man shares, or an employee will suggest a change on which the methods department is already working. These conflicts, unless carefully explained and smoothed out, can cause misunderstandings which go far to defeat any suggestion program. Care and attention to rejects does more than anything else to bring employees back with additional ideas.

All suggestions are filed and cross-indexed in order to prevent duplication of ideas, and the files are separated by departments. Disposition of all suggestions is also recorded in similar files, as are the replies from departments installing new procedures—thus every effort is made to keep track of the entire operation of the suggestion system in detail, as it affects employees, departments, and supervision.

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Address the Editor

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

Scooters equipped with iceboxes make speedy deliveries of "icebox" rivets to 65 assembly-floor refrigerators at Ford Willow Run plant

Scooters for Delivery of "Icebox" Rivets

Scooters equipped with built-in iceboxes deliver "icebox" rivets to 65 assembly-floor refrigerators at the Willow Run plant of the Ford Motor Company, Dearborn, Mich.

One-third of the rivets used in each B 24 bomber are kept in refrigerators. They are made of 17ST alloy, heated to 950 deg. F., quenched, and placed in an icebox at about —20 deg. F. This process of cooling below the freezing point arrests hardening so that the rivets may be kept soft enough to drive within half an hour. Then they harden in the assembly.

•

When employees at the National Cash Register Company, Dayton, wish to borrow athletic equipment at the company recreation grounds, they turn in their badges in exchange at the desk where these articles are given out. Badges are given back to their owners when the equipment is returned. Thus no equipment finds itself lost, strayed, or stolen.

•

Final housings were difficult to maneuver until a special jack was clamped to the worktable, which lifts the castings about an inch, clearing the locator pilot over which the bottom bore of the castings fits

Special Fixture Adds to Hoist's Utility

At most of the machines in the plant of Allis-Chalmers Manufacturing Company, Milwaukee, where heavy, cumbersome parts are machined, overhead hoists are being used for speedy handling. Yet, flexible as hoists are, they must be aided now and then, on certain machine set-ups, with tailor-made devices to bring parts or cutters in and out of machining positions.

Generally simple-looking solutions, such arrangements are often quite ingenious. They might take the form of a specially designed hook forming part of the hitch itself to enable the hitch to clear a machine head, a clamp designed to form a positive hold on a particular part which must be moved with special care and speed, or an attachment for easily moving the part in and out under a machine head to make it accessible to the hoist.

Characteristically, these devices are adaptations for individual situations, although a few fundamental ideas are readily applicable to other set-ups. An example of how these ideas may be applied

is found in the handling of final drive housings.

The housings weigh more than 200 pounds, and were difficult to maneuver under the drills and plate jigs of a multiple spindle drill press until a jack arrangement was devised to swing the castings in and out. Clamped to the T slots on either the left or right side of the worktable, the jack is fitted with a small plate designed to hold the casting in equilibrium during its movement through about 90 degrees on the horizontal plane. Castings are lifted about an inch, clearing the ¼-in. high locator pilot over which the bottom bore of the castings fits.

•

Photo-Electric Device Increases Press Safety

Even though more than two years have gone by without an accident on the huge hydropresses in the press forming shop of Boeing Aircraft Company, Seattle, the company has installed photo-electric safety devices as an added precaution.

Photo-electric cells are installed on each side of the feed opening of the press so that they project a light ray across the opening and in front of the die in use. If a workman accidentally moves within the danger zone where he might be struck by the descending ram, or moves a hand where it could be caught between the ram and lower die, he breaks the ray of light. This break creates an impulse which stops the descending ram and then causes it to rise to its maximum elevation.

Another effective safety device installed on all presses is dual control. One control will not set a press in motion. The operator must actuate both controls in unison before the press starts. This virtually eliminates the danger of a press being set in motion by an accidentally struck control.

•

Recreation for All Listed in Booklet

A booklet issued to all employees at Goodyear Tire & Rubber Company, Akron, lists "an activity for every Goodyearite." Prepared by the department of education and recreation, it tells briefly what is available for employees and their families, and urges them to get in touch with the department personally or by telephone so that it can help them in making plans for individual recreation or for department activities.

All recreation areas and rooms are listed. If a charge is made for the use of any facility, that fact is noted. How clubs can be started, using the employee activities committee to help in the process of organization, to draw up a constitution, to elect officers, and to secure facilities, is explained.

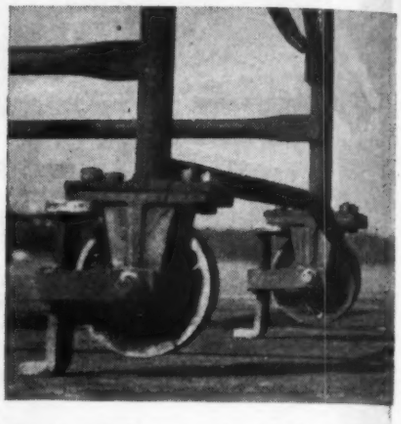
The employee activities committee is made up of a representative from each club, and is incorporated not for profit by the state. An advisory board made up of the chairman, co-chairman, and ten committee members acts for the committee between meetings, and advises the recreation director.

Passing a hand through the ray of light projected between two photo-electric cells stops the ram of the press in its downward thrust and returns it to its highest position. Presses are also equipped with dual controls

"Creeping Ladder" Danger Stopped

A simple device added to a conventional metal stepladder is protecting mechanics at The Glenn L. Martin Company, Baltitore, against the old "creeping ladder" hazard.

An ordinary stepladder, with wheels on the two back legs to permit easy move-



Simple addition to stepladder wheels prevents creeping, yet allows ladder to be moved just as easily as before

ment, is provided with two metal brackets rigidly attached to the back legs, just in front of the wheels and extending beyond them, which lift them off the ground when the ladder is in upright, or working, position. When the front of the ladder is picked up, it rolls back on its wheels, and is as easily moved as ever.

With this device the human element is entirely eliminated. Merely putting the ladder in place automatically raises it off the wheels and leaves it resting solidly on four rigid legs.

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"Quiz" Plan Pays for Plant Knowledge

It pays the workers of Paraffine Companies, Emeryville, Calif., to know plenty about their company and the products it makes. Sponsored by the labor-management committee, a "quiz" program has been inaugurated. Quiz sheets, with right and wrong answers to questions, are distributed weekly for four weeks. Employees are requested to fill them out and return them to the job steward or put them in the suggestion box. Everyone who averages 75 percent on all four sheets is given a 25-cent war stamp "for your kiddies' collection." Those with the highest scores in the various departments are given special awards.

Announcement of the contest is made on billboards, with the words, "Know your job, your company, and your fellow employees . . . and be happy. Be the Quiz Kid of your department."

MAINTENANCE SERVICES

The well-maintained plant is the high-production plant

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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MAINTENANCE as the Editors See It

Better Ways of Handling Maintenance Are Needed Now

MAINTENANCE WILL FACE during the next few months burdens that may well be heavier than any carried heretofore. Schedules for 50 percent of all war production programs are being radically increased—up to 600 or 700 percent for some items.

At the same time the heavily increased needs of the armed forces for more men will aggravate a manpower problem that has long been serious in many plants. With necessary tightening up on deferments, it seems inevitable that maintenance will suffer the loss of some, perhaps many, men.

At any rate all these circumstances produce a situation that calls for hard thinking and ingenuity as well as hard work, plus the adoption of every expedient that will increase the efficiency of the department.

For example, some plants have used women workers in maintenance to good advantage, releasing men for tasks that require strength or technical knowledge.

In other instances a kind of priority system has been carefully worked out for all maintenance jobs. This scheme helps to insure that all essential work will be handled promptly; less important matters wait.

Elimination of all paperwork that is not indispensable to the proper functioning of the department likewise tends to conserve time and manpower.

Placing on foremen and maintenance men greater responsibility for the condition of the equipment in their care, and for proper performance of their work, is often decidedly helpful all around. And, of course, putting the younger fellows more on their own as much and as rapidly as possible saves much supervision time.

When necessity demands it, ways can always be found to speed up work, and devise short cuts that will not impair the quality of the service. Now is an excellent time to seek out these ways.

When Vibration Is Stopped Maintenance Is Reduced

RECOGNITION THAT VIBRATION occurring at the wrong time or place can be surprisingly destructive has grown rapidly in recent years.

Vibration can serve highly useful purposes, as it does in certain types of equipment. Elsewhere it can rightfully be charged with a number of thoroughly undesirable effects. It produces noise, which is fatiguing and nerve-wracking. It puts unnecessary stresses on equipment, increasing wear and deterioration. It may make precision machining or testing impossible. When excessive, it may hasten deterioration of buildings.

There is no novelty about vibration. Its existence has been known ever since machines have been used. Realization of its undesirable effects came much later; while attempts to measure it, and reduce or eliminate it, were made only a few weeks ago, so to speak.

With easy-to-use instruments that have now been developed, it is a simple matter to measure and analyze vibration. When certain facts are known about a given case of vibration, the problem of eliminating it is made much easier and simpler.

The designers and other experts may have probed to the bottom all the possibilities of these instruments. Many maintenance men and engineers have not. But the chances are that they will. And the time is not far off when vibration testing and measuring devices will take their place along with volt and ammeters.

Our Coal Pile Is 40,000,000 Tons Short

STOP ALL POSSIBLE waste of fuel! That warning has been voiced several times in these columns. Recent directives from Washington, calling for the maintenance of lower temperatures in houses and office buildings, and the blacking out of signs and external decorative lighting, emphasize the seriousness of the fuel situation.

The cold fact is that this year there will be a shortage of approximately 40,000,000 tons of bituminous coal. Secretary Ickes has estimated essential demand at 620,000,000 tons. Other authorities estimate this year's production at 580,000,000 tons.

Decreasing manpower in the mines is at the bottom of the failure to meet estimated needs. For example, in 1942, 461,991 workers were in the bituminous mines. For 1943, the number of workers dropped to 416,007, and during 1944 the number fell further to an estimated 400,000. Where did these men go? Induction into the services took many. Disregarding deaths and retirements, the rest found jobs in other industries.

The only way out, obviously, is to make every pound of fuel go as far as possible. In essence, that means extracting the last B.t.u. by careful firing in equipment kept in tiptop shape. Then make that last B.t.u. do the maximum of useful work by preventing waste of heat through such measures as adequate insulation of hot surfaces, proper control of temperature in process equipment and buildings, and returning condensate to the boiler or a hot well. Also avoid, of course, burning lights or operating motors or other equipment when they are not needed.

Simple and effective, these measures are the most potent remedy for a serious situation. There must be no delay in taking a full dose of that remedy at once.

Trouble-Free Lubrication for 4000 Machine Tools

KENNETH HILLGARTNER, General Supervisor of Maintenance, Douglas Aircraft Company, Santa Monica, Calif.

OPERATION of 4000 machine tools without a failure from defective lubrication in a year, at Douglas Aircraft Company, Santa Monica, Calif., is an achievement credited to the introduction of a detailed system to insure that no need for oil or grease will be overlooked or seriously delayed, and that the correct lubricants will be used.

Important additional benefits of this system have been a marked reduction in costs of lubricants and labor, and reduction of as much as 50 percent in the wearing of critical parts.

Although Douglas previously had a plan for systematic lubrication, it was not organized with the attention to details that characterizes the present plan, which is responsible for a considerable increase in benefits.

Two-Part Problem

When the present scheme was instituted, the problem was treated as consisting of two parts: (1) To determine what was to be lubricated, and when and how; and, (2) to devise a scheme that would, as nearly as possible, insure that these lubricational requirements would actually be met, and with the least possible supervision.

The approach to the first part of the problem was to take a census of all machine tools, and the detailed lubricational needs of each.

Under 27 functional classes, the name, size, and location of each machine in the factory, were listed.

Since Douglas had in mind the establishment of a plan under which a routine of lubricational operations would be repeated, over and over—with little supervision—it was decided to confine the plan to machine tools only. These tools are operated, generally, on a high load factor basis, so that they are well suited for systematic lubrication. The lubrication of equipment such as blowers, plant motors, conveyors, elevators, cranes, and rolling stock of all kinds was made the duty of mechanics of the maintenance department, not that of the oilers who care for machine tools.

Lubrication of machine tools at Douglas Aircraft is facilitated by detailed instruction cards and by the use of pushcarts to carry a full assortment of oils and greases. Here is shown one of the lubrication crew members at work within easy reach of his materials

Having determined which tools were to be included, the lubrication planners undertook to settle the questions of when and how. Primarily, this was a process of setting down, in detail, for each machine tool, the lubricational recommendations of the manufacturer. These recommendations were modified only when experience showed such modification to be advisable for specific usage.

After the machines had been tabulated and the parts to be lubricated and the frequency for each part had been recorded, the next step was to prescribe the lubricant for each operation. For this purpose, the assistance of specialized engineering personnel of an oil company was obtained. They made a detailed survey of every type and size of tool, and recommended a lubricant for every need.

One objective of the planning was to reduce the number of lubricants to the absolute minimum consistent with proper protection and operation of tools. Now only eleven oils, six greases, and one flushing oil are used.

The entire compilation of machines, lubricational needs of each, and the lubricant to be used for each need was bound into a master book. Arrangements were made for the addition to this loose-leaf book of the lubricational

LUBRICANT RECOMMENDATION CHART

MACHINE Lindberg Furnace EQUIPMENT No. DPC 3A17140

MODEL No. SHOP No. DEPT. No. 451

Y	B	R	Parts to be Lubricated	Product to Use	Service Period
			1. Blower bearing reservoirs		Daily
			2. Motor mount shaft bearings		Monthly
			3. Counterbalance linkage		Monthly
			4. Door mechanism-chain pulley		
			5. Shaft bearings		Weekly
			6. Gear boxes		Monthly
			7. Sprocket shaft bearings		Weekly
			8. Boston link drive chain		Weekly
			9. All airline lubricators		Daily
			10. NOTE: Sprocket drive chain is not to be lubricated--RUN DRY		
			11. 5 Blowers on each furnace--3 belts each		
			12.		
			13. B85 or 8B8 Dayton V-Belt--Total 15 belts		
			14.		

How often to lubricate and which specific lubricant to use, are listed on recommendation charts attached to each machine tool in the plant. At the left of the card, columns are filled in with yellow, blue, or red crayon to indicate which shift is to do the job. Because operating conditions vary among plants, names of lubricants actually used by Douglas have been omitted from the cards reproduced here

MACHINE Jones & Lamson Thread Grinder EQUIPMENT No. DPC-3-A-239

MODEL No. TG-636 DEPT. 152

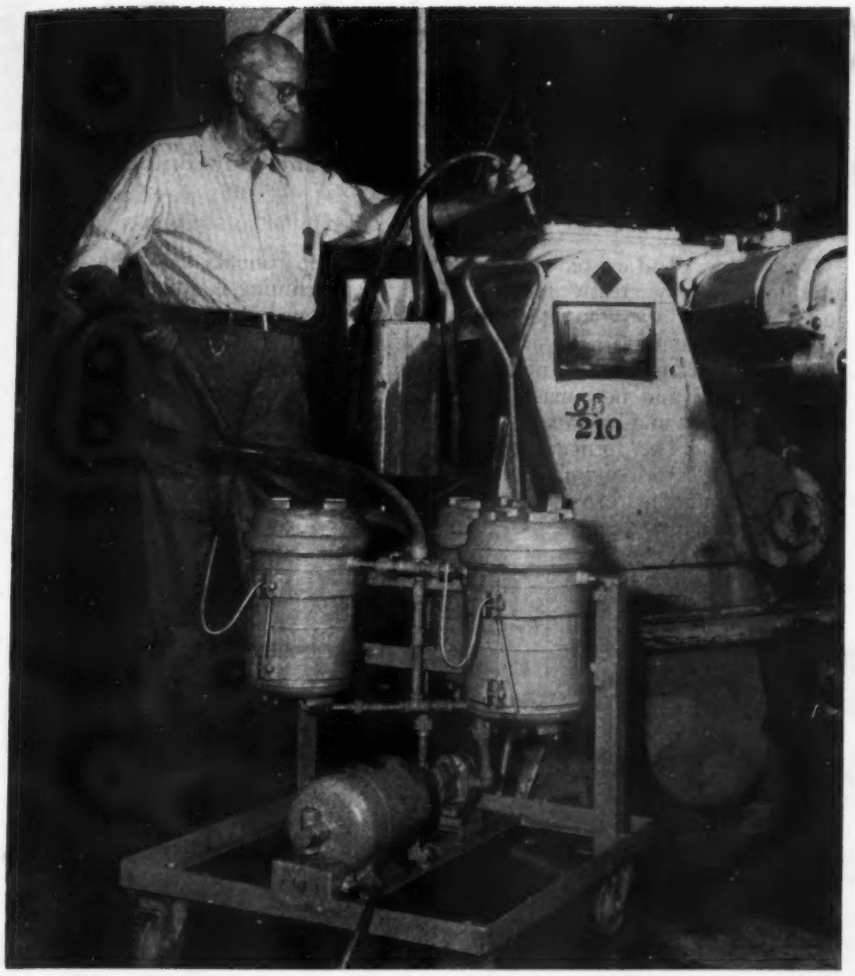
SHOP No.

HYDRAULIC, CIRCULATION, BATH, & COOLANT SYSTEM

System	Lubricant Recommendation	Change Period
1. Headstock		60 days
2. Change gear housing		60 days
3. Hob grinding reservoir		60 days
4. Clean filter every 30 days		
5.		
6.		

SYSTEM	CHANGED	CHANGED BY	NEXT SERVICE DUE	REMARKS
	1-6-44	Palumbo	Mar.-6-44	Dirty
	3-8-44		May-8-44	O.K.

Historical and clinical record for each machine is kept in the maintenance department files



Contaminated oil is cleaned at the machine by a portable filter without stopping the machine. This saves hauling of lubricants and time that would otherwise be lost waiting for drainage

data for each new machine added, so that it might be brought up to date continuously. Department heads and supervisors are supplied with copies of this book. The information is arranged in vertical columns on an 8½x11 sheet, and is similar to that shown on the cards that are affixed to each machine.

The lubrication cards that are attached to each machine, held in a transparent jacket envelope, are for the purpose of designating to the oiler the exact work to be done. At the left edge of the card are three vertical columns, designated yellow, red, and blue. One or more of these columns, as necessary, is colored, with the indicated color, opposite each of the detailed lubricational operations that are described in the adjoining columns. This color designates the shift that is to perform that operation.

Many parts must be lubricated every shift, and in such cases all three columns will be marked with the appropriate color, and the frequency entry at the right edge of the card will read "daily." An operation so marked will then be repeated by each shift, three times in 24 hours. If a part is to be lubricated only once in 24 hours, the frequency entry will read "daily," but only one column, the one indicating the shift that is designated to do that operation, will be colored.

Under the present plan, the factory is marked out in six sections, each a lubrication route. On the day shift, one oiler is assigned to each route, and he performs all the lubricational operations that are coded in yellow on his route. Two oilers are assigned to the evening shift, each covering three complete routes. They do all lubrication tasks coded in blue, consisting mostly of hand oiling. Four oilers on the night or graveyard shift traverse the six routes to perform tasks coded in red, which consist mostly of hand oiling, gear box servicing, and emergency greasing. Thus, only twelve oilers, on the three shifts, are required to lubricate about 4000 machines.

Check Oil Levels

In addition to routine lubrication, oilers are required to verify, as designated intervals, the level of oil in reservoirs, and the level of coolant mixture in the sumps of machines that are so equipped. A few other special lubricational tasks, not specified on the instruction cards, are imposed on shift oilers, but generally any interference is avoided with their main responsibility, which is to follow their routes.

When inspection of oil reservoirs reveals that the oil is contaminated, the lubrication men do not drain and refill but rather filter it by taking a portable filter unit to the tool. For smaller tools, they use a battery of commercial or truck type oil filters mounted on a small cart. For filtering oil in larger quantities, in the reservoir of a large hydro-press, for example, they use a large cylindrical portable filter, through which the oil is forced under pressure from a special pump, mounted on the truck with the filter. This practice eliminates the special handling of new and waste oil, and reduces machine shutdown time, because the oil can be filtered while the machine is in operation.

EVERY MONTH, AMONG THE ADVERTISING PAGES, these valuable aids to low-cost production: the plant operation man's guide to WHAT'S NEW IN EQUIPMENT (page 170) . . . a summary of LABOR DEVELOPMENTS (page 214) . . . things YOU WANT TO KNOW more about (page 200)

No More Oil Mist in the Air

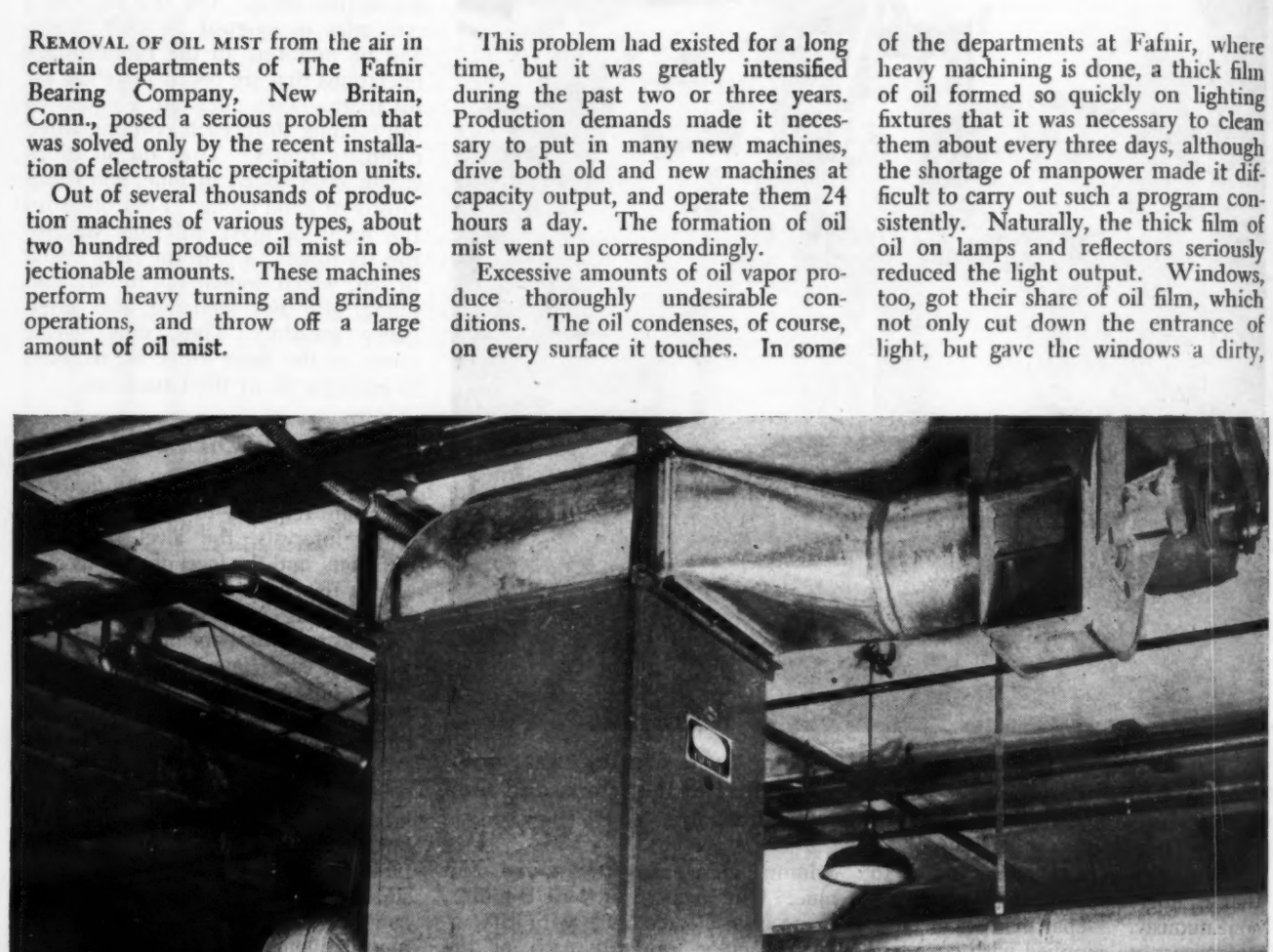
JOHN W. SMITH, Chief Plant Engineer, The Fafnir Bearing Company, New Britain, Conn.

REMOVAL OF OIL MIST from the air in certain departments of The Fafnir Bearing Company, New Britain, Conn., posed a serious problem that was solved only by the recent installation of electrostatic precipitation units.

Out of several thousands of production machines of various types, about two hundred produce oil mist in objectionable amounts. These machines perform heavy turning and grinding operations, and throw off a large amount of oil mist.

This problem had existed for a long time, but it was greatly intensified during the past two or three years. Production demands made it necessary to put in many new machines, drive both old and new machines at capacity output, and operate them 24 hours a day. The formation of oil mist went up correspondingly.

Excessive amounts of oil vapor produce thoroughly undesirable conditions. The oil condenses, of course, on every surface it touches. In some of the departments at Fafnir, where heavy machining is done, a thick film of oil formed so quickly on lighting fixtures that it was necessary to clean them about every three days, although the shortage of manpower made it difficult to carry out such a program consistently. Naturally, the thick film of oil on lamps and reflectors seriously reduced the light output. Windows, too, got their share of oil film, which not only cut down the entrance of light, but gave the windows a dirty,



Electrostatic precipitation units are suspended from the ceiling. Oil mist is drawn up into the hood over the machine and discharged by the fan shown at the upper right-hand corner

dingy appearance that was not at all pleasing.

Electrical equipment likewise suffered. The majority of the older motors are of the open type and trouble was experienced from the start. It was necessary to insist on enclosed type motors because this oily air condition caused many motor failures until the electrostatic air cleaners were installed.

Use of window fans to draw off the oil-mist-laden air was among the schemes tried out in order to improve conditions. Such fans were found to be fairly effective in some departments where the conditions are not very bad. Their use, however, results in a considerable loss of heat, which is not only expensive, but may cause discomfort in cold weather. Employment of women on the machines in this department was impossible under the existing air conditions.

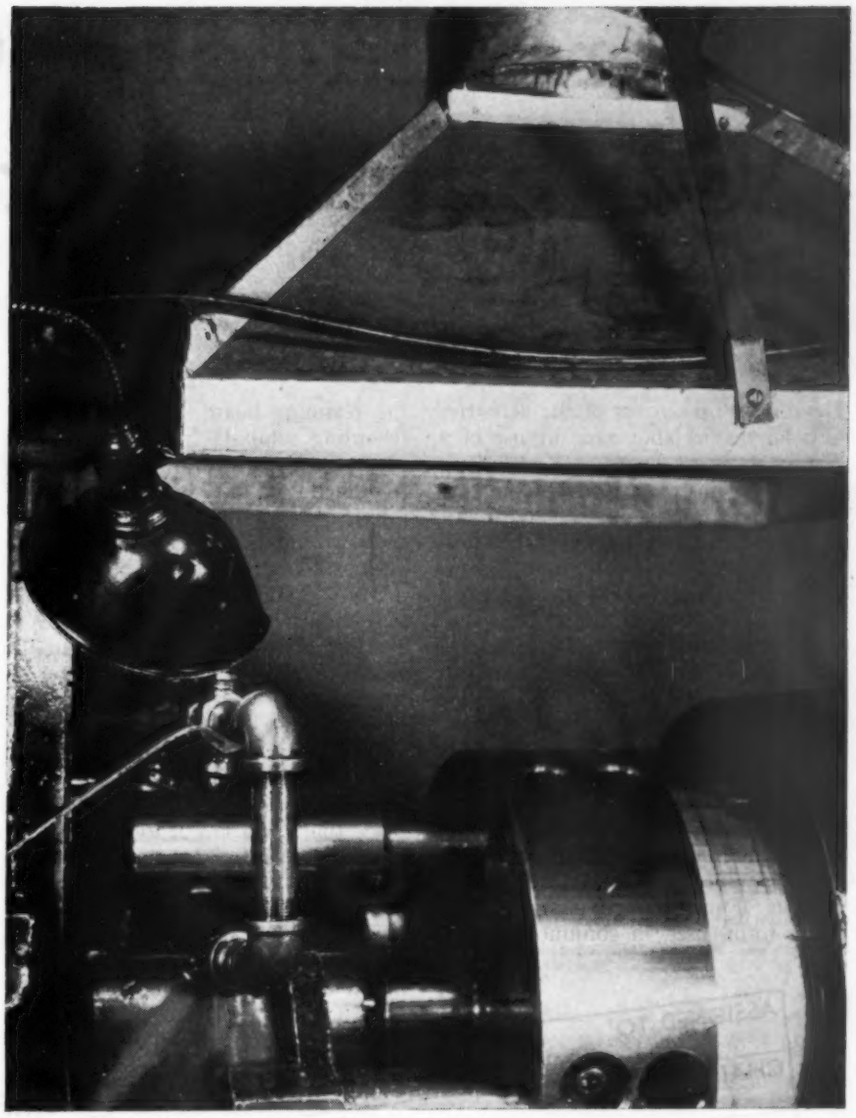
Some other and better methods of removing the oil vapor plainly were needed. Therefore, ten electrostatic precipitation units were installed in one department where bore grinding is done.

Exhausted by Fan

These units consist of a sheet-metal housing or chamber into which air containing oil mist is drawn at the bottom and exhausted at the top by a fan driven by a ½-hp motor. Air entering the unit first passes between wires kept at a potential of 12,000 to 15,000 volts d.c. Any particles in the air are given a positive electric charge. The air then is passed over plates, some of which are charged to about 6000 volts d.c., while the others are grounded. Hence, a relatively strong electrostatic field is produced between the charged and the grounded plates. The positive charged particles, oil in this case, in the air passing over the plates are driven to the negative grounded plate and deposited there.

One precipitation unit serves one machine. A simple sheet-iron hood about 1 foot square was erected over the machine a short distance above the point where the oil mist is produced. Therefore, the mist has no opportunity to spread through the department. Each hood is connected by a 4-in. duct to the intake of the unit. Air that has passed through the precipitation chamber is drawn off at the top of the unit and discharged into the room since it is practically free from oil. About 450 cubic feet of air per minute is drawn into each unit.

The results obtained from this installation of precipitation units were so satisfactory that a second installation of 18 units was put in. It was followed by another installation of 14 units in another plant of The Fafnir Bearing Company. Recently 15 more of these units were put in, in the turning department.



Hoods through which the oil mist is drawn are located directly over, and close to, the point where the mist is formed

In this department 30 large automatic machines do heavy turning. They produced so much oil mist that at times it was impossible to see the full length of the room. That condition, obviously, was intolerable.

Several possible ways of improving conditions were considered. Among these was a proposal to install window fans blowing outward along one side of the department and an equal number of intake fans along the other side. In cold weather the incoming air would, of course, have to be heated by steam coils or electric heaters. It was estimated that the cost of heating by electricity would be approximately $100 a day. Heating by steam would have been less costly, although it, too, ran into sizable figures. Other considerations, however, made the use of steam undesirable.

Eventually it was decided to install 15 precipitation units, letting one unit serve two machines. When these units were put into operation, all trouble with oil mist immediately came to an end. As soon as it is formed, the mist is drawn up into the hood and removed from the air as it passes through the precipitation unit. So far as can be seen, the air discharged from these units contains no oil vapor. Certainly, the air in this department is as clear now as that in any other area of the plant. And there is, of course, no loss of heat.

The oil removed from the air drops down to the bottom of the precipitation unit whence it is returned through a short length of pipe to the oil pan of the machine.

Lower Yard-Labor Costs by Planning Every Move

EDWARD L. COOK, Superintendent of Yard Department, Kodak Park, Eastman Kodak Company, Rochester, N. Y.

EFFICIENT DIRECTION of the activities of a large yard-labor gang by use of a simple planning board at Kodak Park Works of Eastman Kodak Company has been a factor in keeping plant maintenance costs, hence unit manufacturing costs, at a minimum.

Imagine the job of shifting around a yard-labor gang of more than 140 men to meet new assignments over a territory of some 400 acres, and you will have a good idea of the complex problem of obtaining efficient application of yard labor at this plant. Yet by the use of the planning board, one dispatching foreman is easily handling 20-odd labor gangs, and is able to tell at any time of the day what each gang is doing, and what its next assignment will be. Furthermore, a single, simple order form, used in conjunction with the planning board, is the means for recording requests from all over the plant territory for yard-labor services, for scheduling and assigning these requests, and for noting the job-time of each workman. Consequently, accurate yard-labor costs can be reported, allocated, and used for cost control and budget purposes.

Most of the yard-labor men in the Kodak Park yard department are engaged in miscellaneous maintenance work, strictly on the outside of the manufacturing buildings, that is not of a mechanical nature. This work involves unloading freight cars, intra-plant transportation of tons of production and maintenance materials, rubbish disposal, scrap collection, care of plant roads and grounds, and maintenance of plant railroad trackage. To help in this work, automotive equipment, consisting of four trucks, three tractors, and seven flat 4-wheel trailers, is continuously in use, and extra similar plant equipment can be borrowed whenever needed.

For an even better appreciation of the extent of yard maintenance duties, consider that the demands for these services originate over an irregular area 2½ miles long and ½ mile wide, on which are located nearly 100 large factory buildings. In this area there are 10 miles of full-width paved streets, many more miles of unpaved roads, and 8½ miles of trackage. There are also 10 acres of landscaped lawns and athletic fields requiring constant attention. Evidently, great care must be exercised in the dispatching of yard-labor gangs if there is to be no waste of time traveling to and from all points of the compass in such an expansive area.

The centralized location of the yard department headquarters, in which the yard-labor planning board is situated, is

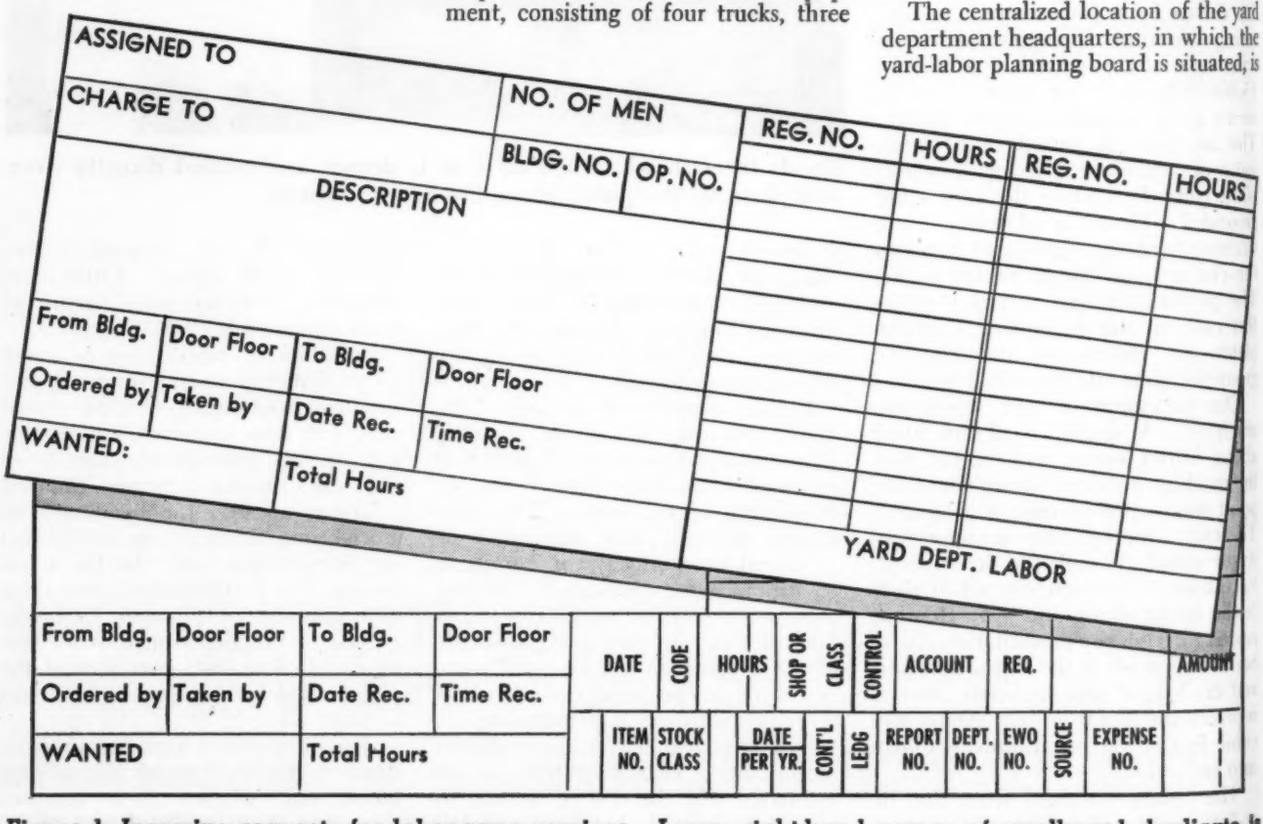


Figure 1. Incoming requests for labor-gang services are written by clerk on a 3¼x7¼-in. order form. Lower right-hand corner of cardboard duplicate is used for statistical cost recapitulation

Figure 2. New orders for labor-gang services are placed on planning board in spaces denoting nature of work. After original copy goes to a labor-gang leader, duplicate is filed on board under his name

therefore an initial contribution to its efficient operation. Here the labor-gang leaders report for work-instructions at the beginning of each day, or whenever the last job or series of jobs has been completed. All instructions are given them in writing on yellow paper form (see Figure 1), 3¼x7¼ inches in size, which provides the essential spaces for describing the nature of work wanted, where it is to be done, and in the case of movement of material, the exact door locations of buildings from and to which the material is to be taken and delivered. There are also spaces on the form for account number to be charged, and for badge numbers and hours worked by the workmen comprising the labor gang, for costing purposes.

Orders in Duplicate

Each order form is made out in duplicate by the dispatching foreman whenever he receives yard-labor orders from the adjacent office of the yard superintendent or, as is usually the case, by telephone from production or maintenance supervisors in any one of the numerous factory buildings. The carbon duplicate form, which is a light-colored index card, is similar in layout to the original form, but also contains in the lower right-hand corner an added space for recapitulation of labor cost statistics.

As soon as an order is received and written, both original and duplicate are placed together on the planning board by the dispatch foreman. When the job is assigned, the original is taken from the planning board and given to the labor-gang leader. The duplicate is marked accordingly, but held on the planning board, in a different position, until the original order is returned upon completion of the work. The job-time data that are entered by the labor-gang leader on the original form are then checked and transferred by a clerk to the duplicate form, which is sent to the accounting department. The original form is used to obtain a monthly distribution-of-labor summary for the yard superintendent, and is then filed away for one year. If a complaint should arise, for example, of non-delivery of materials, the actual disposition of such materials, or the reason for any mistake can be traced from the original form.

Complaints of non-performance of requests for labor-gang services are infrequent, however, because the planning board that directs the work is arranged to prevent loss of orders or burial of important orders below less important work. The planning board is located diagonally across the center of a room that opens through a doorway directly out to the yard. Labor-gang leaders need only enter the door from outside and wait at a dividing rail partition for their instructions. Close by the board are located the desks of the dispatch foreman and clerk. The board (see Figure 2), constructed of wood, is 10 feet long and 5 feet wide over-all and is mounted waist-high on vertical wooden studs running from floor to ceiling. The entire board is painted light green, and marked off in black lines to make eight horizontal rows and ten vertical rows, or a total of 80 6x8-in. spaces. In each space is an inverted U-type wire spring-clip for holding the work orders.

Above each space on the planning board is a caption indicating either one of two steps in the status of an order. Either an order is waiting to

be assigned, or it has already been assigned. In the former case, the caption describes in one or two words the nature of the work to be done. Such are the spaces marked "Cars," designating a job of unloading freight cars, or "Drums," prescribing the use of a special elevating tail-gate truck to facilitate movement of heavy drums, or "Pick-up," calling for collection of refuse or scrap. There are more than 20 other spaces captioned with building numbers, singly or in groups, to show where materials are to be called for. These spaces, incidentally, are arranged schematically on the board to show as nearly as possible the geographical relationship of the buildings they represent. Consequently, the dispatcher can at a glance size up the work load in any one vicinity, and can then lay out the most efficient route of assignments.

For the same purpose of holding unassigned work, there are six spaces marked "Rush" for orders needing prompt attention. This segregation, right in the center of the board, enables the dispatcher to find and schedule such work, which is combined whenever possible with work elsewhere on the board in the same vicinity. There are also six spaces captioned for each day of the week, in which to assemble orders to be executed on those particular days. When the day arrives, its daily accumulation is removed from that space and redistributed to the other spaces for customary assignment.

Orders Accumulate

The detail into which this planning board can be broken down is illustrated by one space captioned "Lights." This space accumulates orders for repair of plant street lamps that have been reported out of service the previous night by the watchman service.

There are some 50 spaces on the planning board for posting unassigned work. They cover the top half of the board, and most of the right side. Orders in these spaces consist of the original form with its duplicate.

On the lower left half of the board are grouped the spaces for orders that have been assigned. Here only the carbon duplicate forms are kept, inasmuch as the originals have been given to the labor-gang leaders. These spaces are arranged under the names of the labor-gang leaders, which not only gives a quick inventory of each leader's work load, but also enables easy correlation of the carbon duplicates with the completed originals when they are returned.

There are no limitations to the number of active orders that can be efficiently scheduled and dispatched through the labor-gang planning board. In actual operation it is responsible for controlling yard maintenance work of a continuously changing nature that usually clears the same day it is assigned. And because such work involves a daily expenditure of more than 1100 man-hours, spread over a daily average of some 250 new orders, the function of the planning board of Kodak Park is considered to be irreplaceable.

THE AMERICAN WAY

America was built on a basic idea. The idea that a man—any man, every man—shall be master of his own destiny. The idea that a man can work a little harder than his neighbor and enjoy the fruits of that labor. The idea that ambition and courage will be rewarded.

The idea that a man can go into business for himself. The idea that he will be privileged to risk his time and his money in an enterprise of his own choosing. The idea that he can start a store, or a service station, or a restaurant, or a factory.

A factory—that is a basic thing, like a tree. Through the chemistry of its complex workings it produces fruit in the form of payrolls; and payrolls are manna for the grocer, the baker, the doctor, the preacher, the teacher, and the whole intricate life of a community.

The sum of the factories, large and small, constitutes the forest we call industry. American industry—most potent force in the land!

A factory—it starts with a man or a group of men. Because this is America, men are not afraid. Men are willing to struggle and take risks. And from this, from this basic American idea, comes the greatest of all great rewards of industry—the creation of jobs—the creation of opportunity for the returning veteran.

Jobs. Work. Industrial payrolls. They support the farmer, providing a market for his harvest. They support the merchant, creating his customers. They support the utilities, the lawyer, the banker, the newsman, the policeman, and the whole body of public servants. They support other industries, and in turn support themselves.

They are America, and while they survive—while Americans have the freedom of opportunity and enterprise—this land will be strong.

Like the tree, the factory has roots—the deep, life-giving roots that convert labor, materials, and risk into the miracle of the American way of life. *E. W. Daniels, President, Harbor Plywood Corporation, Hoquiam, Wash.*

Green is a "cool" color, so good psychology impelled Ashland Corporation, Jewett City, Conn., to use it on the walls of its slasher room where temperatures in summer tend to get out of hand

COLOR IN THE PLANT

FABER BIRREN
Industrial Color Consultant, New York

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Why Color—and How to Use It

COLOR IN THE PLANT is not new. A handful of companies have been using it these past dozen years. But it is only recently that a sizable segment of industry has come to consider its use. Now would therefore appear to be the time to set down ways and means, scientific and otherwise, to its practical application—and to point out some of the dangers inherent in its use.

Color, indeed, is not something for industry to rush into. Color has obvious charms. It holds a lot of magic. But restraint, control, and direction are needed if it is to be used intelligently. To give it free rein in a factory may well lead to digressions which defeat their own ends; if color is cheerful to look at, it can also be mighty bothersome to human eyes struggling to concentrate on something else. Just because the factories of yesterday had little or no color in them, there is the danger that the well-meaning enthusiast will overdo things, will shoot all the way past the benefits that may be expected from a conservative and well-devised program.

There is, indeed, one good viewpoint for plant operating men to adopt: *Color is not an end in itself.* If it is to be used at all in the plant, it must be used with purpose.

Seeing That Makes the Task Easier

One vital fact should be understood. Factory decoration is not interior decoration in any sense of the word. In principle, one does not get people to work harder and more accurately by inspiring them with color. Quite the contrary, the trick is to establish a seeing condition that automatically, in and of itself, makes the task easier. In other words, color does not stand around on the sidelines like a cheerleader. It digs in with the worker's own problems of seeing, directing his attention rather than competing for it. It is integral with production and not a thing apart.

To draw the conclusion that, because color is used in our homes, it should therefore be used in our factories, is largely specious. When a man sits in the middle of his living room and tries to compose a letter with the lights all on, the chances are good that his attention and interest will wander to the more amusing things within his field of view—pictures, draperies, wallpaper patterns, knickknacks. And the chances are that his letter will not be written very quickly or very well.

The industrial technique avoids distractions. Men who are expected to work and to concentrate on their jobs are aided directly by wall colors that have a slightly grayish cast, by brightness ratios that are well within 1 to 10, by color tones that complement materials rather than blend in with them. Excessive contrasts are thereby reduced, distractions overcome. Note that the aesthetic factor is not included. Appearance, in truth, is seldom an end in itself. It tags along as the automatic byproduct of a job well done.

Lately, for example, there has been a good deal of talk about using color on ceilings. This may be a mistake. Colored ceilings, particularly if they look nice, may get people to glance up and away from their tasks. This distraction will emphasize pipes, girders, and things that certainly are not handsome and have no importance in the seeing routine of the worker.

In studies of casual eye fixation and random movement of the eyes, the two factors most compelling to the attention are motion and extreme brightness. In the realm of colors, all equally illuminated, white has far less attraction than hue. The human eye finds an unconscious interest in hue and shows indifference to neutral gray and white.

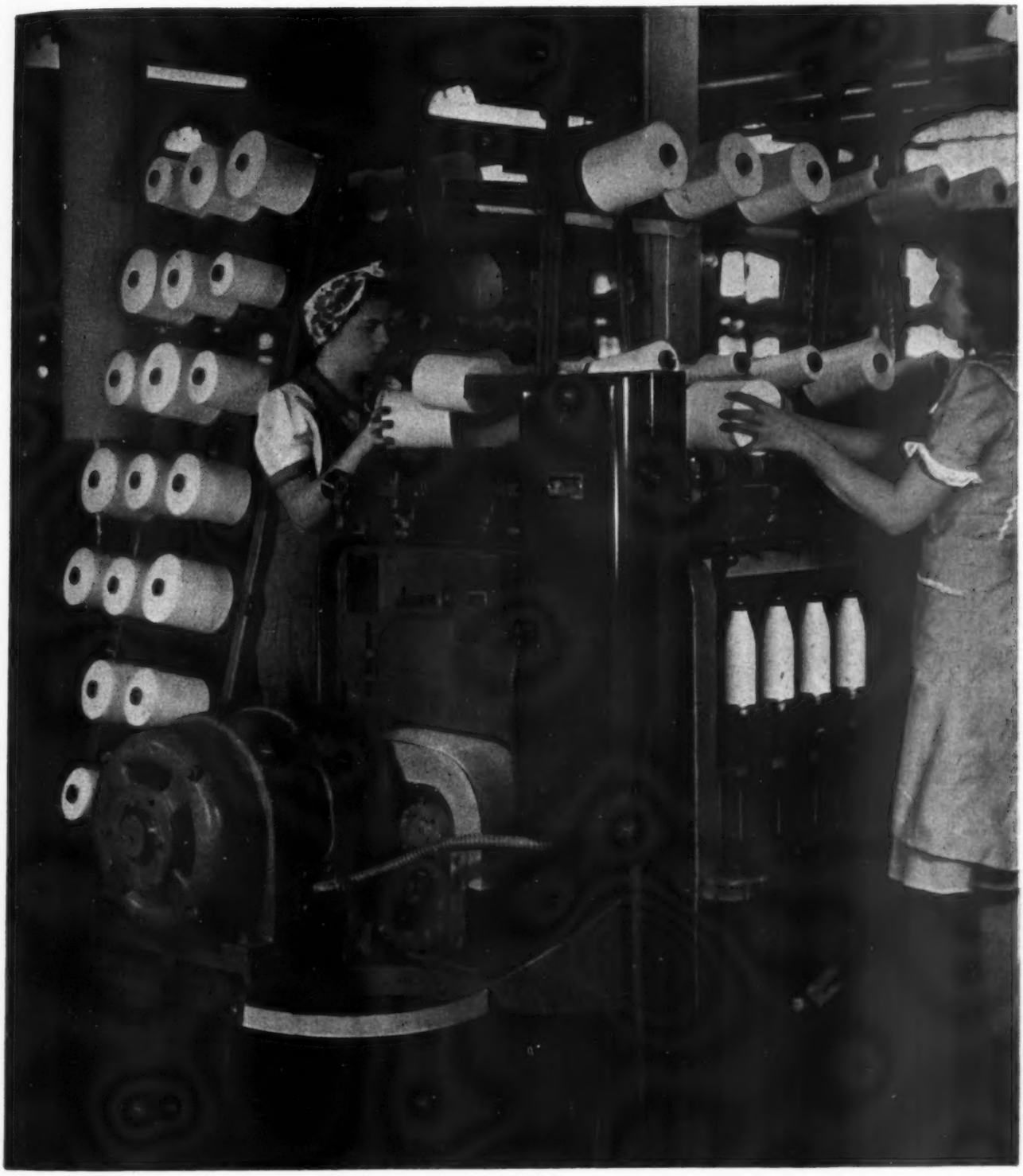
Use of Color Overhead to Be Avoided

Finally, any color overhead will quench light. If the fixtures have directional reflectors, the darkness of the ceiling will be lowered just that much more. And severe contrast, to state a fundamental law of seeing, is one of the major causes of eye strain, fatigue, and physical discomfort. Obviously, color on the ceiling will work overtime in thwarting production and human efficiency.

Technically, color is not of first importance, anyhow. As Dr. Matthew Luckiesh, a noted authority in the lighting field, phrases it:

"High visibility, ease of seeing, and

Peach and medium blue, chosen for stairwell walls at Ashland Corporation, provide pleasing color and a dado not easily soiled



Machines are light gray, switchboxes blue, guards yellow, ceilings white, at Paul Whitin Manufacturing Company, Northbridge, Mass. Red is reserved for fire protection equipment. Light green, with dark gray dado, is used for walls and columns to avoid sharp contrasts in light and dark

good seeing conditions are overwhelmingly the result of good brightness engineering."

Brightness exists aside from the element of color. High brightnesses reflect light; low brightnesses absorb it. The first approach, therefore, is one of expert control over the reflectance values of all areas within the field of view. After all, the human eye rarely sees light itself. Rather, it sees the things that light reveals. Although ample levels of illumination are necessary in industry, specifications are not complete until this light has been properly balanced in terms of surface brightness.

"Investigations of the most diverse kind," says Prof. Parry Moon of Massachusetts Institute of Technology, "show that a human being sees best and visual fatigue is reduced to a minimum when the entire field of view is of approximately the same luminosity as that to which the fovea (center of eye) is adapted."

With this fact accepted, color en-

Restrooms at Arma Corporation, Brooklyn, are finished in various color combinations, each chosen with a view to providing tired workers with not only a pleasing but also a restful change of scene

gineering steers wide and clear of any personal notions. Opinions are not what count, for the use of color may follow a precise scientific method.

As to brightness relationships, Luckiesh states that ratios smaller than 1 to 5 are desirable. Ratios higher than 1 to 10 should be avoided if possible. Ratios in excess of 1 to 100 should not be tolerated.

If these recommendations may serve as rules, the planning of color schemes in industry is by no means an affair of putting a dash of something here and there merely for the sake of a good appearance. On the contrary, the first thinking must be done in terms of large, general areas.

The ceiling will probably be white as a starter. If tasks are performed at machinery, dark machine colors such as the conventional machine-tool gray may demand fairly deep wall tones (35 to 50 percent reflectance). This, of course, will waste some light. If, however, it becomes practical to refinish the machinery in a lighter tone, the walls may be correspondingly lighter. And the same with floors. In other words, brightness engineering provides uniform seeing conditions, with extreme contrasts in light and dark smoothed out.

This initial study finds the element of color still unwrapped. Soft brightness ratios are easy on the eyes, whether red or blue, orange or green. The technique involved has measurable rather than arbitrary elements to it. Definite formulas are to be worked out with the same regularity of a problem in mathematics. Obviously, the artistic touch would be an awkward gesture here and one that should be disregarded.

Wall Tones Handled in Soft, Pale Hues

With brightness levels determined and manipulated through illumination and paint, the use of color may now be considered. Sound practice is not merely to frost the cake. Wall tones, for example, are handled in soft, pale hues having fixed reflectance values. They are slightly grayish both to avoid distraction and to resist soiling.

In one plant, where a fine assembly operation was being performed, brilliant colors on walls had the curious effect of making the room in general more interesting than the job. As a consequence, the worker left his bench more frequently and experienced the unconscious desire to glance up and away from his task. In difficult seeing problems, wall colors should obviously be soft and non-aggressive.

For machinery and equipment, a well-planned color sequence is followed. Miscellaneous objects of minor importance to the worker (bins, racks, shelving, etc.) are kept low in color purity lest they do a lot of meaningless flag waving. Color is then neatly concentrated at points of operation. Here the specifications are accurately worked out and decided upon through straight visual measurements, production records, and employee reactions. The whole problem is objectively analyzed. No attempt is made to give the worker what someone thinks he

ought to have—or even what he himself might like.

On the contrary, the one best answer is to be justified in terms of result. In a southern hosiery mill, for instance, a difficult topping operation was aided by installing blue panels behind the working field—to blank out distractions, hold the eye to a more uniform level of adjustment, and build up higher visibility. Management promptly reported: "The operator can do better work with less eyestrain. There is a definite improvement, and the operators would not willingly do without it (the shield) if their choice in the matter were considered."

On large pieces of factory equipment like ovens, driers, and power presses, massive areas of color are avoided to prevent a "world's fair" appearance. Average psychological responses are capitalized and color is employed to offer visual compensation for dark and vault-like spaces, or for

Not only are ivory and tan pleasing colors when used in combination; Goodall Company, Sanford, Me., also uses them to aid good seeing on stairways

One wall white, one light yellow, at Magnetic Metal Company's plant, Camden, N. J. Red fire extinguisher area has been located so that it does not distract the operator while he is working

unfavorable exposure to high temperatures. Even in the foundry, where a general coat of paint may last little longer than the time required to put it on, color is specified in certain smaller but none the less choice locations where it will give the worker some visual clarity through the fog of his surroundings.

Needed Relaxation Planned

In critical seeing tasks there is a chance to speed operations and reduce fatigue. The field of ophthalmology has several measurements of eyestrain. Pupil dilation during the course of the working day, convergence reserve, rate of blinking, degree of collapse of the "visual form fields"—all these lend themselves to instrumental study.

In crowded interiors where the worker has his eyes almost constantly fixed on near objects, and where almost everything within his view is on the bright side, a needed relaxation is planned. Colors on far end walls (the eye needs a distance of 20

Good use of color has transformed the rewinding department at Ashland Corporation from a typical mill room into one that women enjoy working in. They say the soft yellow walls give them a real "lift"

feet to relax its convergence) not only make a room pleasant, and give it a different appearance from different directions, but also invite rest to the eyes and relief of tension to the mood. There is a purpose for color here; and in this instance it happily blends the scientific approach with the emotional and pleasurable.

In the application of color to safety the functional use is really the only one holding any value at all. For example, good safety practice requires that red be reserved exclusively for the identification of fire protection equipment. In one plant, where the individual switchboxes of machines had been painted red, several workers were unexpectedly asked to locate fire extinguishers. The confusion that resulted was argument enough to discontinue the practice.

In safety, colors should be coded. Each hue use should be reserved for a particular function—and it should not be confused with anything else. If there are no "wolf cries," the employee may be readily trained to understand the significance of what he sees —to be constantly prepared and ready for emergencies. If the color application is haphazard, or merely to make things pretty to the eye, it does little more than prevent a man from going about his business and keeping his mind on it.

Colors Coded for Employee Safety

A satisfactory code, which coordinates the best of tradition and precedent, has recently been developed and endorsed by safety authorities. In this code, *yellow* is reserved for strike-against hazards; *orange* is standard for hazards likely to cause serious injuries such as cuts, shocks, burns; *green* is for the identification of first aid equipment; *red* for fire protection devices; *blue* for caution and to indicate machinery and equipment not to be moved or operated; and *gray* (*white* or *black*) for traffic marks, waste receptacles, and other less vital things. The code has had the benefit of practical use in several factories and is under consideration as a nation-wide standard.

Finally, the more pleasant and less scientific job of designing color schemes for employee facilities—washrooms, restrooms, cafeterias, dispensaries—is again pulled adroitly from under the nose of so-called interior decoration. The color engineer always stresses an objective viewpoint. Observations are made of employee traffic during the normal course of a working day. From this study, sequences are worked out so that the employee will be treated to an agreeable "change of pace." Needless to say, a lot of care must be taken lest the total result be too garish.

Incidentally, brighter colors are allowable and desirable in purely "casual" spaces—in contrast with working areas where the environment must be less distracting. Yet even in non-productive spaces the research method may be respected. The right and wrong of color is no more effectively demonstrated than in a washroom. Any attempts at subtlety or fussiness will almost invariably bring forth guffaws from the employee and questions as to why management is squandering its money. If, however, color preferences are considered, as well as facts and figures developed on mass reactions to hue, the washroom treatment can be so obviously gratifying that the worker finds his likes cornered and his innate feelings satisfied.

Comprehensive color plans for industry are comprised of almost endless little parts. Yet the whole program must fit together. The maintenance department must not be asked to keep a heavy inventory of paints. Unlike a home where rooms may be handled individually, the industrial picture must be integrated. The big problem is not to be approached as a series of different things. The plan must have basic elements, and into it must be fitted all minor needs and requirements. Many plants have begun a program of color, only to give up when the result seemed to get more chaotic as more painting was done. With a major plan decided upon, and all departments and operations correlated with it, the rehabilitation of the plant may proceed smoothly—with full assurance that the net result, next month or a year from now, will be not only effective but also essentially simple, functional, and impressive.

How Selected Plants Use Color

Allied Kid Company, Wilmington, Del. Color has been adapted to the general needs of tanning operations. Neutral grays have been used to facilitate inspection and avoid distorting reflections. Blue-green tints compensate for high temperatures in several departments. On some machines light blue is employed at point of operation (with gray reserved for other areas) in order to concentrate the operator's attention and isolate vital parts from their surroundings.

American Cyanamid Company, New York. Office and drafting room space in Rockefeller Center, ranging from rooms below ground level to facilities above the sixtieth floor, were studied. Conditions of extreme glare from sunlight are met by the use of soft gray tones on walls. In windowless space, monotony is overcome by using a light warm gray on side walls and by employing different colors on the opposite ends of the room—pale yellow and medium blue. This helps to offer

Two entirely different, but equally good, color combinations used in a shoe factory, illustrate wide range of choice that may be exercised and still meet the requirements of sound color engineering

variety as the employee moves about from one department to another during the courst of the day.

Ashland Corporation, Jewett City, Conn. This textile plant has selected color combinations to fit working conditions in various phases of its operation. Green, for example, is used because it is a "cool" color in a department where temperatures tend to run fairly high in summer months. In other sections of the plant, combinations of yellow and gray, peach and gray, and so on, have been chosen because they help insure good seeing conditions—also because workers like them. Workers, in fact, had a voice in their selection.

Consolidated Edison Company, New York. This is a general maintenance shop. White is used on most upper walls for ample light reflection. Occasional areas of soft blue and green on end walls relieve monotony and offer agreeable areas for visual and emotional relaxation. A complete safety code has been established, with yellow used for strike-against hazards, orange for acute hazards such as on cutting devices, green for the location of first aid equipment. Red is reserved for fire protection equipment.

Davis & Geck, Inc., Brooklyn. In the manufacture of surgical ligatures, soft gray walls are employed to minimize glare, to avoid emotional and visual distractions from colorless materials, and to dramatize cleanliness by emphasizing the white garments and white gauze pads used by employees. Blue is used on some end walls to rest the eyes after severe convergence on fine operations such as the threading of needles. Brighter colors are employed in other facilities such as offices and washrooms for an interesting "change of pace" during plant traffic.

Henry Disston & Sons, Philadelphia. An integrated color program has been designed to aid in the rehabilitation of a large group of buildings, some new and some old. Basic color standards have been employed in a variety of ways for the sake of efficient maintenance and to assure variety. Factory areas infrequently used are mainly gray and white, with light blue-green and soft yellow employed in other departments to give them emphasis and interest. In the hand saw etching department, side walls are white with gray dado, while end walls are blue and yellow. The walls of a sun treatment room for male employees have been finished in three tones of blue for a cool and restful atmosphere.

Marshall Field & Company. Several southern textile plants manufacturing blankets, towels, sheets, bedspreads, rugs, etc., have been studied as integral parts of an over-all program. White has been freely used on wall areas to avoid severe brightness contrasts with sunlit windows. To lend psychological relief, entire end walls have been painted light green in some instances to suggest "coolness." Special consideration has been given to facilities occupied mainly by women; washroom treatments are in tones of rose and are based on the best selling colors in Marshall Field merchandise itself—thereby satisfying average human preference. Safety colors and symbols are specified for hazards customarily found in textile plants, and practical applications of color-code principles have been made wherever possible in Marshall Field mills.

Pabst Brewing Company, Milwaukee. Pale tones of peach and bluish green are used to compensate for temperature extremes found in refrigerated rooms and kettle rooms. A study has been made of visitors' routes for post-war times. A subtle shift in general atmosphere will greet the eye during course of traffic. In the kettle room, walls are in soft tones of blue, tanks in an appetizing peach tone. Special tests and specifications have been set up to facilitate bottle inspection and other rather difficult seeing tasks.

Parke, Davis & Company, Detroit. The color program embraces a wide variety of problems that range from fine inspection to laboratory work, general maintenance, etc. Basic principles have been worked out in which different functional uses for color are specified under different conditions. Most colors are light in tone to encourage good housekeeping and cleanliness. Blues and greens are locally applied to tables, machines, and cubicles where the employee is confined during the day. This is done to give the employee a better sense of isolation.

Radio Corporation of America. Studies were first conducted in the application of color to machinery in the RCA Victor Division, Camden, N. J. Two-tone schemes in gray and buff were applied. Management reports, "No lost-time accidents have occurred; headaches and other complaints due to fatigue have dwindled." The program was later expanded to include wall areas in the factory and office sections. Green and ivory were the main hues chosen. In some instances, illumination was increased 100 percent through colors of higher reflection on ceilings, walls, and equipment. RCA has now worked out a complete painting program for all facilities.

Servel, Inc., Evansville, Ind. A large windowless building has been functionally treated to aid production and to help offset any feeling of being confined. Side walls are in three tones of gray which remove glare from the field of view, and build up ideal contrast and visibility for materials. End walls are blue at one end of the interior and yellow at the other. This gives the interior a different appearance from different directions and draws attention from the lack of window outlooks. Brighter colors are used for washrooms which are located below floor level—rose tints for women employees and blue for men.

John B. Stetson Company, Philadelphia. A sizable group of multi-story buildings are correlated in appearance through the development of an over-all color program. Stairways are in yellow and tan to offset lack of natural light. Many working areas are pale green and have specially designed shields (in blue) behind small machines and sewing operations to blank off distracting motion in the worker's field of view. Attention has been paid to integrated production units, with color employed to isolate various departments from one another.

Sylvania Electric Products Company, Salem, Mass. In the incandescent lamp plant, special studies have been made of difficult seeing tasks, such as the assembly of lamp filaments. Proper brightness ratios have been established to create a soft and uniform seeing field, to screen out distraction and glare, and to give the worker a better sense of isolation in his particular task. Generous areas of blue-green on side walls are employed where the employee is exposed to high temperatures. These color schemes are then held in interesting contrast and sequence with other spaces such as stairwells, offices, washrooms, and cafeteria.

Paul Whitin Manufacturing Company, Northbridge, Mass. As in most textile mills, machinery used to be finished in the conventional dark green supplied by equipment manufacturers. Result was dark workrooms. Now machines are light gray; walls and building columns are light green with a darker green stripe and gray dado; ceilings are white. Sharp contrasts in light and dark are thus avoided. Safety colors are coded—blue for switchboxes, yellow for machine guards, red for fire protection equipment.

How to Get the Most From Commutators and Sliprings

J. V. DOBSON, Chief Engineer,* Stackpole Carbon Company, St. Mary's Pa.

Best commutation depends on maintenance of a uniform film of copper oxide on commutator. Requisites for film formation:

1. Brushes must ride the commutator properly

2. Contact points must be held relatively intimate

3. Friction must be low—which means good follow

4. Brush contact drop must be suitable

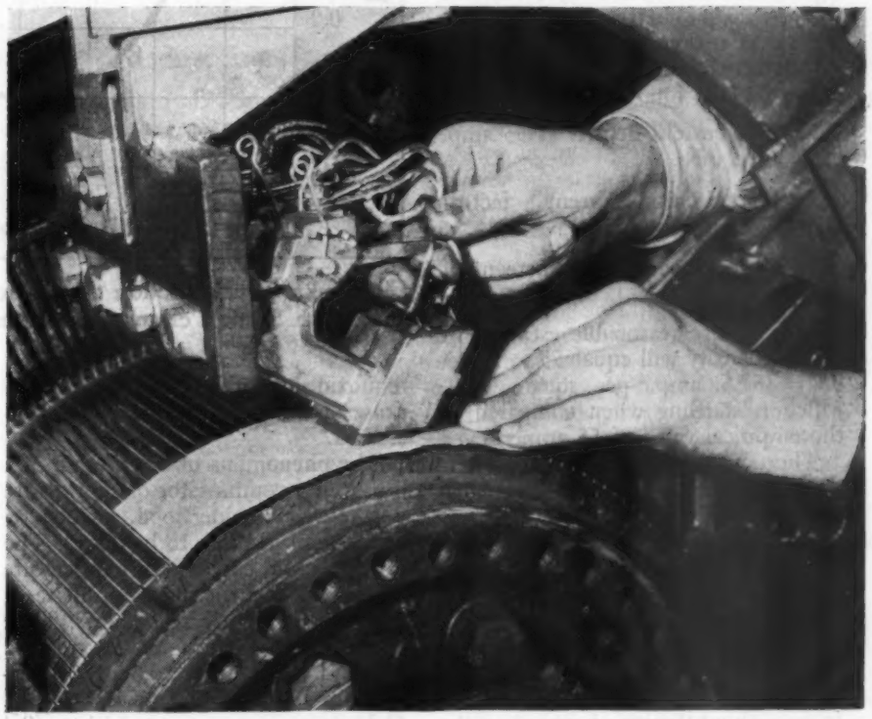


Figure 1. Intimate contact between brush and commutator is assured when brushes are carefully sanded in with No. 0 or No. 00 sandpaper. Paper is placed sanded face up and held firmly against the commutator, then pulled circumferentially in the direction of rotation—not across the brush face. This brush-holder is the double-brush type

CURRENT COLLECTION from metal surfaces of rotating electrical contacts, such as commutators and sliprings, is best when a copper oxide film surface is present. Breakdown of this film surface materially affects the efficiency of commutation, because it depends largely on the number of contact points between brush and surface.

Research engineers have recognized this basic commutation problem for a long time, and have contributed much to its solution through the development and improvement of brushes. The insistence of design engineers on greater exactness in specifications and closer adherence to allowable tolerances during manufacture, has materially improved the commutation of machines produced on a volume basis. Operating engineers have learned the need for a uniform chocolate-colored, copper oxide film surface if current collection is to be as good as it should be and, therefore, do everything possible to insure trouble-free operation, even to the selection of brushes.

Recognition of the functions of film surfaces of rotating electrical contacts brings realization that brushes and contacting surfaces are both essential factors in commutation; also that the matter of fitting one contact member (the brush) to the other member (the commutator or slipring) is of predominating importance.

Good commutation over a sustained period necessitates very intimate contact between brush and commutator or ring surfaces (see Figure 1). The so-called current density in amperes per square inch of brush area is only an empirical figure. It is not even an average value. Rather it is a value arbitrarily chosen, yet based on experience, as representing some safe value of load current that can pass through a brush section when conducting current to or from a sliding contact surface. The actual current density depends on the number of contact points and their area. It is not possible to know actual values for any given application, which explains why the empirical method is used. The actual figure is sure to be very much in excess of selected values.

For example, a careful research test was made by discharging a condenser across contact surfaces of a highly polished brush surface to a highly polished copper surface, held together under pressure equivalent to that usually applied to a brush in service. This sudden high current discharge caused a blackening of the copper where the points were not in contact and left unchanged the color of the points where intimacy of contact was obtained. Careful integration disclosed that not more than 20 percent of the brush area was making contact. Other research shows a much lower figure.

Since this test was made under ideal conditions, on a stationary contact, it

* Coordinating engineer for Westinghouse Electric & Manufacturing Company, East Pittsburgh, and Stackpole Carbon Company.

is reasonable to assume that the actual contact area of sliding contacts may be much lower.

Current density must be based on the sum of the short-circuit current in the brush face and the load current; therefore, the latter must be increased by some factor. While it is not possible to measure the value of short-circuit current in a commercial machine, nevertheless it is there, and from laboratory tests it can be reasonably assumed to be 25 to 35 percent higher than the normal load current.

To visualize better the difference between a reasonable estimate of current density and an empirical value for it, assume the following:

1. Load current density at 55 amp. per square inch.

2. Short-circuit current factor: 1.3 × load current density.

3. Points of contact: 20 percent of brush area.

Therefore, a reasonable estimate of current density will equal $55 \times 1.3 \div 0.2 = 357.5$ amp. per square inch, which is startling when compared to the empirical value of 55 amperes.

The point to be emphasized is that the brush should maintain a very intimate contact with the commutator or slipring surface. It will be realized immediately that the reasonable estimate of 357 amp. may be considerably increased if good brush follow on a commutator is not maintained.

There is some value of current density beyond which it is not safe to go without danger of exceeding the softening or melting point of copper, and going beyond the wasting point of the carbon brush material. When this value is exceeded the result is a marring of the smooth commutator surface or a cratering effect in the brush face. If carried to extremes, there is formation of glass-hard copper beads.

This effect is caused by raising the point or points of contact to a temperature above the melting point of copper when the bar is under the brush. As the bar comes out from under the brush, the temperature is decreased, and a bead is formed. From there on brush wear is rapid; the brush cannot follow the commutator, brush friction is increased, and commutation is impaired.

The cratering effect on the brush may be described as that condition occasioned by the excess in current density actually wasting away the carbon; not that a melting point has been exceeded, but rather that the overheated carbon contact points combine with oxygen to form carbon monoxide or carbon dioxide gas. Because of this effect, friction is also increased.

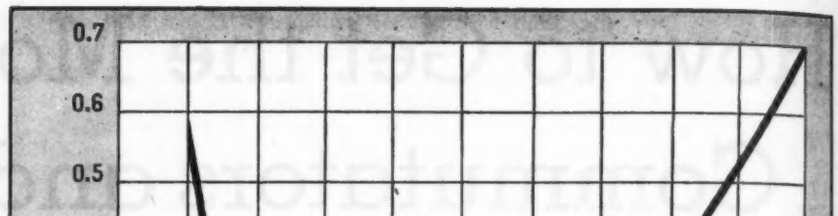


Figure 2. Brush friction curve, based on laboratory data, shows how the brush friction changes with an increase in brush temperature

The phenomena of dry friction of a brush on a commutator or slipring are not very well understood. Much research work remains to be done. The brush friction curve, with temperature as abscissa and friction as ordinate, is a hyperbola, as Figure 2 shows. The apex of the curve is downward and may be minimum at about 0.1 between the range of 75 and 105 deg. C. Cold friction may be as high as 0.4 or even higher. Hot friction may be 0.75, and it has been observed to be as high as 1. Exceptions to these general figures can be stated. For example, values as low as 0.08 have been read. Such exceptions emphasize the need for more research work, because if such low values can occasionally be obtained, it should be possible to secure them consistently.

Why Carbon Brushes

Brush contact drop is another important consideration. For commutator machines, either motor or generator, it must be from 1.5 to 2.5 or even 3 volts. That is why carbon brushes are used. There is a voltage drop between the face of the carbon brush and the commutator that opposes the voltage of armature reaction and thereby reduces the flow of short-circuit current in the coil or coils under the brush.

The speed with which the commutator bar passes the brush is important. Much difficulty is experienced in collecting current from very slowly moving surfaces due to the localizing of the current on a point contact for too long a period. The amount of real trouble caused thereby is small, however, because there are not many such applications. High-speed machines, from 5000 to 10,000 feet per minute, present the more difficult contact problems. Their solution is found in improved brushes and commutators, and better maintenance.

Motor or generator specifications are becoming more and more precise. The exact power requirements are fully understood. The machine is designed to these specifications. Commutator manufacture is much more accurate than it used to be. Bearings are much better. Armature rotating balance is considerably improved. The results all favor better commutation. In addition better brushes are obtainable, better in respect to brush riding ability, higher current-carrying capacity, and lower brush friction. The net result is that when a motor or generator passes through the manufacturer's test floor, a high degree of commutation is obtained and many of these machines go into service and maintain that excellence of commutation throughout service life.

Some do, however, give commutation difficulties. The troubles are usually not of the emergency type, but rather are the result of long periods of operation under adverse conditions. These applications furnish opportunities for further study of the factors underlying commutation. A review of these trouble jobs is proof that, for one

reason or another, the breakdown of the film surface of the commutator is the root of the trouble for practically all the difficult applications today.

No single operating condition has more emphatically emphasized the importance of film surfaces than the experiences gained with generators in high-altitude flying. There, in the rarified atmosphere, the loss of oxygen from the oxide surface of commutator copper caused extremely high rates of brush wear, as the loss of the film produced a surface that was the equivalent of a fine file, and rapidly wore the brush away. The solution was found in a specially treated brush.

The same technique that was used in the research for a better high-altitude brush has recently been applied to machines operating under ordinary conditions. It is hoped that a chemical means of film forming or of film repair will result, so that a suitable copper oxide film of sufficient depth is continuously maintained for a good commutation surface. Progress has been made, and gratifying results have already been obtained.

Unlike the higher atmospheres, the air surrounding the earth's surface is laden with many gases. Pure copper is susceptible to attack by many chemical gases or fumes. It is not unusual to find a newly turned commutator excessively tarnished overnight. Some films are advantageous, and some are injurious, from a commutation standpoint. That is why operators in the chemical industry have found it expedient to use brushes that have a relatively high cleaning action, even though commutator wear may be greater. Thus the commutators are operated with a bright copper color instead of the preferred chocolate color, simply because the injurious films give more commutation trouble than a thin, but definite, film surface.

Guard Against Dust

Dust or dirt in the atmosphere causes even more trouble than gas, and the only way to avoid its effects is to remove it from the ventilating air before it reaches the commutator surface. Dirt will break down the desired film on a commutator surface very quickly, and when this has happened the puncture in the film surface is continuously enlarged, and impaired commutation results. Even a few grains of sand under a brush face are sufficient to injure a commutator film surface.

An oil-laden atmosphere, or the leakage of oil or grease onto the commutator or slipring surface, is also objectionable. There is not much that can successfully be done except to remove the cause. Here is what happens: The oil catches the dust, dirt, and carbon particles that pile up under the face of the brush. This material fills the undercut slots and covers the commutator surface (see Figure 3). The brush must then ride that surface. As current passes through the film, the oil breaks down to form a carbon deposit on the commutator surface and commutation is impaired.

Another highly undesirable result is the leakage of current from one commutator bar to the other when oil, grease, or smudge fills the undercut slot. This current leakage eats away the commutator bar mica, sometimes to the extent of commutator failure. It can be seen, therefore, that contaminating gases and vapors, dust and dirt, oil and grease, are not conducive to the maintenance of a uniform chocolate-colored copper oxide film surface.

Expedients favoring proper filming conditions are sometimes adopted. For example, there is a strong tendency to use double-brush brush-holders; that is, two brushes placed one behind the other circumferentially in the same brush track, as in Figure 1. The metal wall between the two brushes is necessarily thin because the total thickness across the two brushes must be within the commutation zone.

The advantages of such brush-holders are:

1. The mass of each brush is cut almost in half, hence if an impact from a minute commutator irregularity is imparted to the brush, the lower-mass brush is on the commutator a longer period of time because one brush may be down while the other is up so that more contact points remain engaged.

2. There is a higher resistance to the flow of short-circuit current and the actual current at the points of contact is thereby decreased.

3. The brush does not waste so quickly, and there is less tendency for carbon to deposit on the commutator surface.

Some older motors and generators use relatively thick brushes, say ¾ to 1 inch thick. With these machines it is possible to use split brushes placed side by side circumferentially in one holder. In this case the split brushes are under one pressure finger. This arrangement is not so good as a double-brush brush-holder, but it obviates the need for new holders.

Improved commutation also results when brushes are staggered ⅛ inch or more. Staggering is done by pairs of brush arms (Figure 4), not alternately,

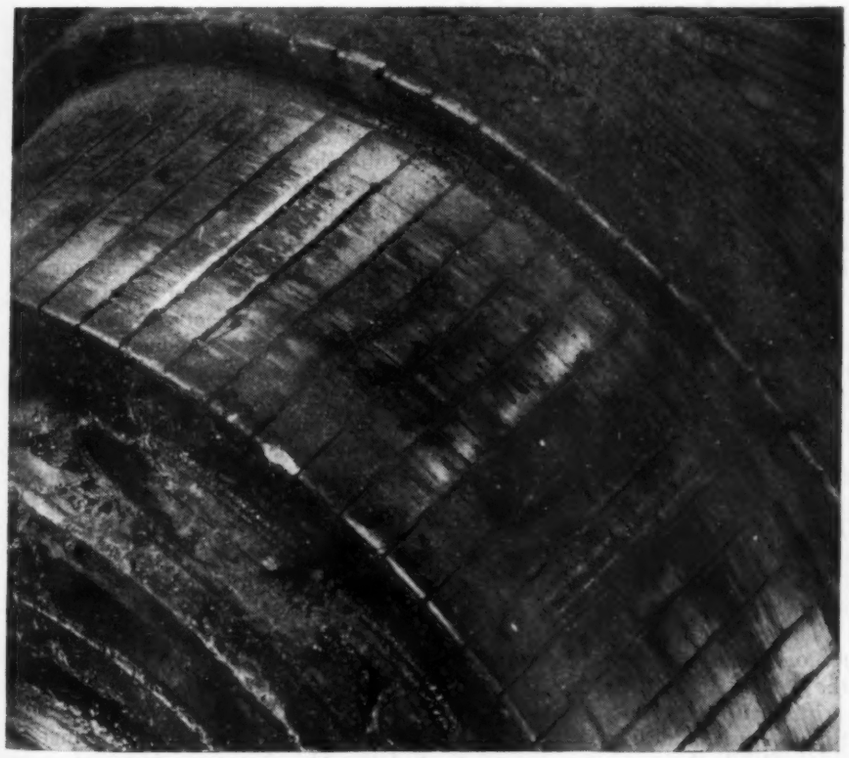


Figure 3. Inadequate maintenance is responsible for this threaded, grooved, and smudged commutator. Oil and grease have filled the undercut slots, resulting in a flashover that severed the V-band. The copper oxide film surface is extremely poor

with one set of brushes positive, the other negative.

It is amazing to note how much current unbalance there can be among brushes in parallel on the same polarity. This unbalance can be up to six times normal on a machine which, to all ordinary appearances, is performing quite satisfactorily.

Check for Unbalance

Even though there may be no indication of trouble, there are enough instances where current unbalance does cause severe trouble so that the possibility of its existence should be realized and measures adopted for its control. For example, it costs no more to tighten all bolted joints snugly in the brush shunt and brush arm circuit than it does to do the job carelessly. A careless job can cause no end of trouble so far as current unbalance is concerned, and, ultimately, poor commutation.

Similarly, poorly shunted brushes, corroded terminal connections, badly corroded shunts because of -atmospheric attack, improperly aligned and improperly spaced brush-holders are all factors that affect current unbalance.

In what manner is current unbalance injurious? It was shown previously that 55 amp. per square inch current density is a purely nominal rating, and that 357 amp. per square inch might reasonably be a more nearly correct value, considering the area of the contact points. If there is a current unbalance of six times normal, however, it is easy to see how these values could increase materially. It is obvious that the copper points or the carbon points of contact may waste away. When the copper points are overheated, the film breaks down, beads are formed, and threading and grooving of the commutator surface result, as Figure 3 shows.

Helical grooved commutators and sliprings have been adopted for some applications with distinct advantage. While this practice is not a cure-all, there are not many applications where grooving causes more difficulty than lack of it. Cutting grooves does represent an expense, and if the job is not done properly, it should not be done at all.

These helical grooves, usually about ¼ inch wide and ⅛ inch deep, are cut spirally on the commutator surface. The pitch has not been definitely fixed. Some operators cut about two to the inch. Others recommend a much greater area of commutator width to groove width. In any event, any tool that cuts the groove will upturn small particles of copper on the surface. These particles should be removed by running a very slight bevel at the groove edge.

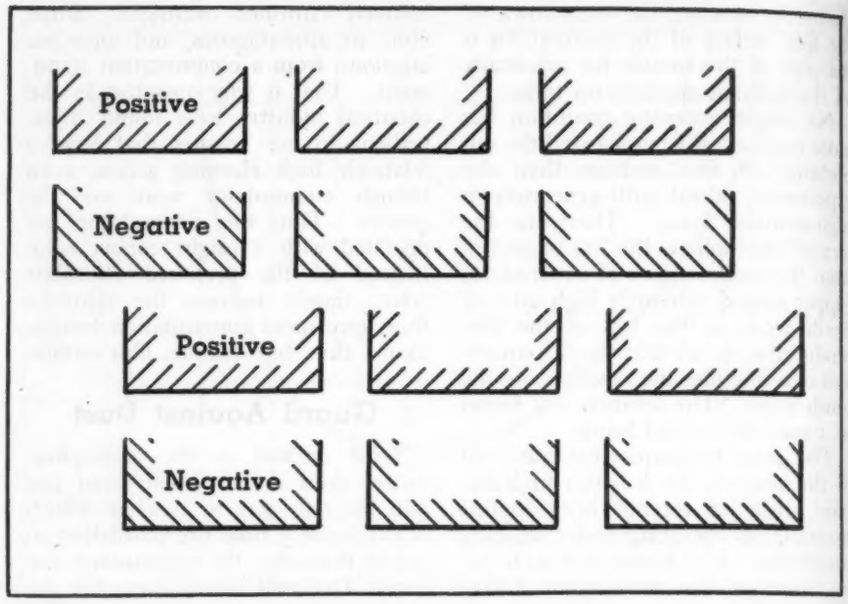


Figure 4. Staggering brushes ⅜ inch or more helps to improve commutation. Note that brushes are staggered by pairs of brush arms

The advantage of the helical grooved ring is that it tends to give a much more even distribution of current in the brushes in the parallel circuits. That is, if there are several brushes on one brush arm the current balance between those brushes is improved because of the effect of the negative coefficient of resistance of carbon. If current flows to one corner of a brush, causing glowing, the negative coefficient of carbon (the higher the temperature, the lower the resistance) will cause more current to flow to this point, thus unloading other brushes or other sections of the one brush. Then the helical groove simply wipes off this low contact point.

There are some other advantages, such as better cooling of the face of the brush; the carrying off of dust or dirt particles; and possibly some improvement in commutation.

Most grooved commutators observed over a period of years show a uniformly filmed contacting surface. There appears to be a more extensive use of grooved sliprings, particularly on high-speed rings, 12,000 feet per minute or more, than on commutators.

The main obstacle, however, to the more general adoption of grooving is the cost of doing the work.

Frequently the complaint is made that a brush grade is too hard or too soft. While there may be some justification for such statements, it is usually not the hardness of the brush that is of primary concern. This statement is made with some reservation because it is recognized that there are some brush grades whose particle structure and density may be such as to abrade copper. The threading and grooving that usually form the basis of the complaint, however, are more frequently due to the progressive breakdown of the film surface than to the brush material itself.

Check for Brush Friction

Brush friction is also an extremely important consideration. Sometimes friction becomes so great that definite brush chatter results, because the brush is actually bouncing up and down on the commutator. Under such conditions brush noise is severe, and brush breakage or loosening of shunts can result. In addition, the brush may be impacting the commutator surface with sufficient force and friction to cause a tearing away of the copper particles from the commutator surface. This can happen even though the commutator is truly concentric. The contact points are torn off much in the same manner that a fine file removes copper particles from a smooth copper surface.

Mention must be made of the means within the brush to produce the best film surface on the copper. It is noteworthy that some brush grades can exercise a good film-forming effect, whereas others may have quite the opposite effect. Formation of the film, however, does not come from the brush as such, but is induced when operation conditions are suitable to one brush grade and not to any other.

Conditions Inventory of Plant Service Equipment

5. Materials Handling Equipment (Part I)

GIVE A HIGH PRIORITY to a conditions inventory of materials handling equipment. Without the help of such equipment, large-volume mass production would be difficult, and low-cost production impossible, to attain.

Raw materials, of whatever kind, must be taken from railroad car or truck to storage or stockpile. When needed, these materials must be moved promptly, oftentimes continuously, to production machines or processes. Work-in-process must be moved from one machine or manufacturing unit to another until all required operations have been performed, then to storage, or to assembly, to inspection, eventually to shipping and again into cars or trucks.

Some of these operations—for example, where moving very heavy weights is involved—could not possibly be done by muscle power alone. Others could be done by hand, but only at fantastic cost in manpower, money, and time.

Well-designed, properly applied materials handling equipment is, then, a full-fledged partner of high-output machines. But it cannot make its full contribution to large-volume, low-cost production unless it is in first-class condition.

The wear and tear of hard service, poor maintenance, overloading or other forms of abuse, adverse operating conditions—all produce the common result of decreasing efficiency and causing breakdowns. Then bottlenecks develop, production machines must slow down or stop, output falls off, costs skyrocket.

In this and the following pages will be found the principal points to be inspected when determining the physical condition of some of the more important kinds of materials handling equipment commonly used. Other types of materials handling equipment will be considered in an early issue.

Previous articles in this series were: 1. Motors and Generators (October); Mechanical Power Transmissions (November); Heating, Ventilating, and Exhaust Systems (December); Electrical Distribution Systems (January).

SPIRAL, ROLLER CHUTES

1. General condition
2. Wear of, mechanical damage to, bottom and sides
3. Rigidity, strength of braces and supporting structure
4. Corrosion
5. Condition of rollers and bearings
6. Adequacy of provisions for lubrication
7. Proper spacing of rollers
8. Suitability for the service
9. Condition of trap (fire) doors and release mechanism
10. Need for painting

CONVEYORS

Apron

1. General condition
2. Condition of platforms and blocks, cleats, or brackets
3. Condition, wear of chain
4. Condition of slides or rollers, and tracks
5. Rigidity, strength of supporting structure
6. Corrosion, mechanical damage of parts
7. Adequacy of provisions for lubrication
8. Condition of motor and control
9. Condition of mechanical drive
10. Suitability for the service
11. Need for cleaning, painting

Arm Elevators

1. General condition
2. Condition of belt, chain, or platform
3. Condition of arms
4. Rigidity, strength of supporting structure
5. Wear, condition of slides, rollers, tracks
6. Corrosion, mechanical damage to parts
7. Suitability of provisions for lubrication
8. Condition of motor and control
9. Condition of mechanical drive
10. Suitability for the service
11. Need for cleaning, painting

CONTINUED ON NEXT PAGE

Conditions Inventory of Service Equipment *(Continued)*

CONVEYORS *(Continued)*

Belt

1. General condition
2. Wear, defects in belt
3. Condition of idlers or rollers, and bearings
4. Condition, suitability of fasteners
5. Suitability of provisions for lubrication
6. Rigidity, strength of supporting structure
7. Corrosion
8. Condition of motor and control
9. Condition of mechanical drive elements, including tail pulley
10. Broken, defective skirt boards
11. Suitability for the service
12. Need for cleaning, painting

Bucket Elevators

1. General condition
2. Wear, condition of chains or belt
3. Wear, general condition of buckets
4. Condition of sprocket, or pulley, shaft, bearings
5. Corrosion of parts
6. Rigidity, strength of supports
7. Condition of motor and control
8. Condition of mechanical drive elements
9. Adequacy of provisions for lubrication
10. Wear, mechanical damage to chutes
11. Suitability for the service

Chain Trolley

1. General condition
2. Condition of track and supports
3. Worn, defective trolleys
4. Condition of load-carrying devices
5. Wear, defects in chain
6. Suitability of provisions for lubrication
7. Corrosion of parts
8. Condition of motor and controller
9. Condition of mechanical drive elements
10. Suitability for the service

Roller Flight

1. General condition
2. Wear, condition of track and supports
3. Wear, condition of chains
4. Wear, defects in rollers
5. Adequacy of provisions for lubrication
6. Corrosion of parts
7. Condition of side boards or guides
8. Condition of motor and controller
9. Condition of mechanical drive elements
10. Suitability for the service
11. Need for cleaning, painting

Gravity Roller

1. General condition
2. Distortion, condition of frame
3. Condition of rollers and bearings
4. Proper spacing of rollers for parts handled
5. Corrosion
6. Suitability of provisions for lubrication
7. Condition, mechanical damage to guard rail
8. Need for cleaning, painting

Live Roller

1. General condition
2. Distortion, mechanical damage to frame and supports
3. Condition of rollers and bearings
4. Corrosion
5. Wear, defects in driving belt
6. Suitability of provisions for lubrication
7. Condition of motor and controller
8. Condition of mechanical drive elements
9. Condition of guard rails or guides
10. Suitability for the service
11. Need for cleaning, painting

Pneumatic

1. General condition
2. Wear, mechanical damage to pipes
3. Rigidity, strength of supports
4. Condition of containers
5. Condition of air tank
6. Condition of dust collector
7. Leakage at connections or joints
8. Wear, defects, general condition of fan or blower
9. Condition of motor and control
10. Corrosion
11. Need for cleaning, painting

CONVEYORS *(Continued)*

Push Bar

1. General condition
2. Wear, condition of chains
3. Rigidity, condition of supports
4. Condition of crossbars
5. Adequacy of provisions for lubrication
6. Condition of motor and control
7. Condition of mechanical drive elements
8. Wear, mechanical damage to carrying bed
9. Corrosion
10. Need for cleaning, painting

Screw

1. General condition
2. Wear, breakage, condition of spiral and mixing paddles
3. Wear, general condition of trough or box
4. Wear, condition of bearings
5. Condition of motor and control
6. Condition of mechanical drive elements
7. Suitability for the service

Suspended Tray

1. General condition
2. Wear, condition of chains
3. Defective, broken trays
4. Wear, condition of sprockets, shafts, and bearings
5. Wear of tray suspension
6. Corrosion
7. Condition of motor and control
8. Condition of fingers, other parts of loading and discharge stations
9. Condition of mechanical drive elements

CRANES

Crawler

1. General condition
2. Wear, defects, condition of track shoes
3. Wear, condition of sprockets, track rollers, track carrier rollers
4. Condition of front idlers, shafts, bearings, release springs
5. Distortion, breakage of frame
6. Condition of engine, radiator, need for repairs or replacement of parts
7. Condition of starting engine or motor
8. Wear, breakage of transmission gears, shafts, clutches, bearings
9. Wear, breakage of bevel drive gear, pinion, bearings
10. Condition of steering clutches, brakes, drums, bearings, linkages
11. Condition of bumpers, drawbar, drawbar guide, tow hook
12. Wear, breakage of swing gear, frame rollears, bearings, shafts
13. Wear, defects in hoisting drums, shafts, bearings
14. Condition of drum gears, shafts, bearings
15. Wear, proper operation of clutches, brakes
16. Distortion, general condition of boom
17. Condition of sheaves, shafts, bearings
18. Condition, need for replacement of cable
19. Condition of lubricating devices
20. Need for cleaning, painting

Locomotive

1. General condition
2. Condition of trucks, driving gears, shafts, bearings
3. Condition of car body
4. Condition of boilers and engine, need for repairs or replacements (if steam driven)
5. Condition of engine, need for repairs or replacements (if powered by internal combustion engine)
6. Condition of motors, controls, wiring (if electric driven)
7. Condition, need for repairs or replacement of storage batteries
8. Wear, breakage of swing gear, rollers, bearings, shafts
9. Wear, defects in hoisting drums, shafts, bearings
10. Condition of drum gears, shafts, bearings
11. Wear, condition of clutches, brakes
12. Distortion, general condition of boom
13. Condition of sheaves, shafts, bearings
14. Condition, need for replacement, of cable

Health and Safety Equipment

Health and safety equipment introduced to you by *Factory* during the past 12 months is reviewed here to give you a quick one-year summary

COTTON FACELETS—for attachment to type R-1000 or similar standard respirators, are said to improve their wearing comfort and protective qualities. They are reported to help prevent skin irritation, and to be particularly valuable where workmen handle cement, lime, and gypsum, or in paint spraying. American Optical Company, Southbridge, Mass.

EAR PROTECTORS—are reported to absorb noise in the high frequencies that are harmful to nerves and hearing and, at the same time, carry through lower, slower frequencies, permitting the wearer to hear conversation. The protectors, known as "Speco," contain a special absorbent material sealed on the inside. Industrial Products Company, Philadelphia.

FACE SHIELD—of lightweight protective Plastacele is equipped with leather sweatband for added comfort and fiber spark deflector for added protection. The Type J-1 shield is fully bound, flexible, and the visor, quickly replaceable, provides unhampered vision and is adjustable at any angle. Jackson Products, Detroit. (Figure 1)

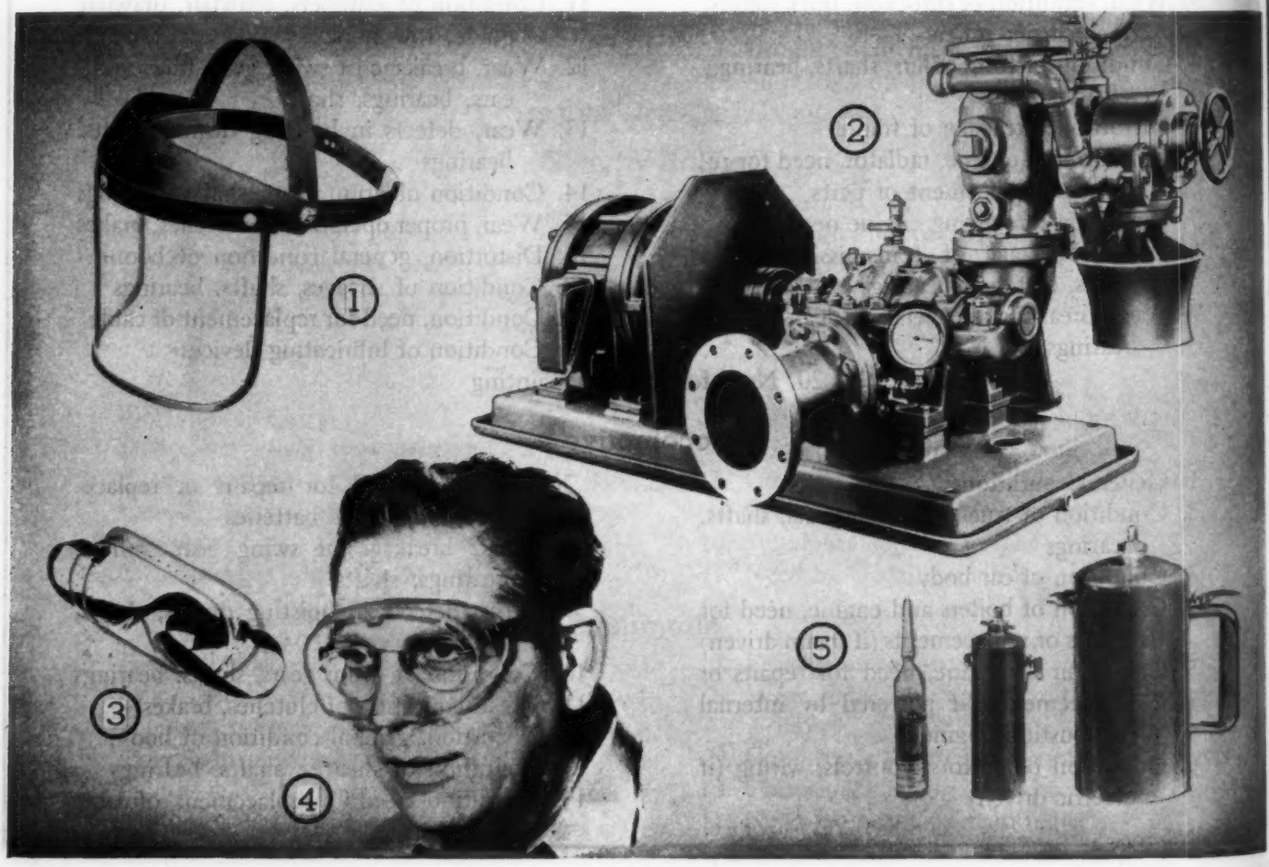
FIRE PUMPS—designed for low-cost fire protection, are approved for heads ranging from 60 to 108 p.s.i. at capacities ranging from 500 to 1500 g.p.m. The single-stage, double-suction fire and booster pump units include pump with brass plugs, umbrella cock, increasers, and capacity plate. Allis-Chalmers Manufacturing Company, Milwaukee. (Figure 2)

GAS MASK—is equipped with a canister containing a special filter for respiratory protection against toxic dusts, fumes, mists, fogs, and smokes. Known as the Model S "All-Service" gas mask, it is said to have lower breathing resistance because of its large filtering element. Mine Safety Appliances Company, Pittsburgh.

GOGGLE—made of Lucite and acetate non-flammable plastic, is treated to resist scratching and constructed so that lens does not touch surface when placed on table. Called "Saf-I-Shield," it allows clear vision both to the front and sides, and is wearable over glasses. U. S. Safety Service Company, Kansas City, Mo. (Figure 3)

GOGGLE – called "MonoGoggle," features high impact strength, unobstructed vision, and high degree of comfort. Has a single replaceable plastic lens that is designed to be crystal-clear and non-shatterable. It can be worn over any prescription glasses. Willson Products, Inc., Reading, Pa. (Figure 4)

GOGGLE CLEANING EQUIPMENT—known as "Brite-Ize," simplifies cleaning of goggles, glass-faced dials, microscope and inspection lenses. Consists of a pressure-type dispenser



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THE ELECTRIC STORAGE BATTERY CO., Philadelphia 32

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filled with cleaning fluid which is said to remove fog, grease, grime, or splatter, leaving no halation. The Brit-Ize Company, Chicago. (Figure 5)

HAND CLEANER—in the form of a hand-sized, semi-quilted, porous pad, contains an absorbent substance that is reported to be effective in removing all types of oil from the hands or arms, leaving them clean and dry. Called "Flix," it is claimed to prevent oil dermatitis, to be non-flammable, and to remove oil from machine parts. Waverly Petroleum Products Company, Philadelphia.

INDUSTRIAL GLOVE—with thumb and two-finger guard, No. 15160, is made of chrome leather and is large enough to fit over cotton gloves. Guard is inseam cotton-thread sewed or outseam steel stitched. Industrial Gloves Company, Danville, Ill. (Figure 6)

INSECT KILLER—called the "Whizooka Roach Gun," is a pump-action, canister gun. Comes fully loaded with a supply of Lethane A-70, and shoots a cloud of deadly dust into cracks and runways, wiping out roaches, ants, silver fish, and bedbugs, though harmless to animals and humans. R. M. Hollingshead Corp., Camden, N. J.

LENS CLEANING CABINET—designed to facilitate cleaning dirty lens of safety goggles and spectacles, is said to remove smudges of oil and grease, leaving no film to catch dust and lint. Compact in size, cabinet contains a sprayer, a bottle of K-Lens-M fluid, and lint-free cleansing tissues. The Wilkins Company, Cortland, N. Y.

LIGHTWEIGHT GOGGLES—made of plastic, are said to provide full protection against impact while affording wearing comfort. Air space is claimed to eliminate fogging, and the frame is designed to shield against distracting reflections in addition to protecting the entire eye area. Called "Cover-Lite." Chicago Eye Shield Company, Chicago. (Figure 7)

MOBILE CAFETERIA—serves hot meals, utilizing three Aervoid vacuum insulated food carriers and one liquid carrier for dish-up or pre-packaged service, to workers in the plant. Hand brakes on each end hold unit stationary while serving, and lock protects contents against tampering. Vacuum Can Company, Chicago. (Figure 8)

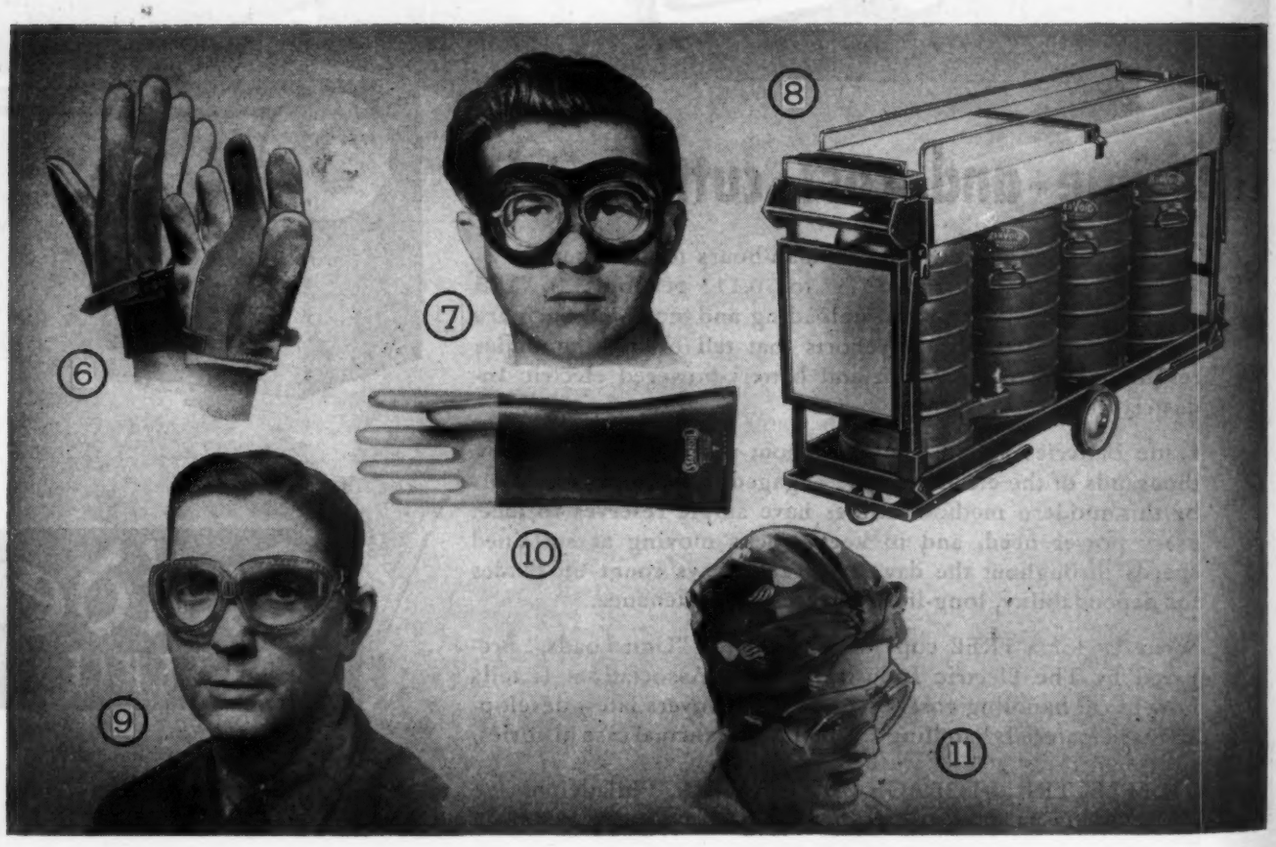
PLASTIC GOGGLES—trademarked "Looks," are designed with individual eye cups molded to fit the facial contours, and with large "aviation-type" lenses to provide a wide, unobstructed angle of vision. Wide elastic headband holds the goggle in place at low tension, assuring wearing ease. Mine Safety Appliances Company, Pittsburgh. (Figure 9)

PROTECTIVE CREAM – called "Solu-Glew" is applied to the skin like vanishing cream and is said to form an invisible dry film that prevents penetration of grease, paint, and dirt into the skin pores. Rinses off with ordinary water. Turco Products, Inc., Los Angeles.

PROTECTIVE HAND CREAM—to guard against water-soluble cutting oils, dilute acids, alkalis, and other water-chemical mixtures, is designated as "Pro-Tek No. 2." Applied to the hands and arms before starting work, it forms an invisible glove of film lasting from 3 to 4 hours. Is stated to be neutral in reaction and non-irritating. E. I. DuPont de Nemours & Company, Wilmington, Del.

PROTECTIVE GLOVE – designed for use in light assembly and inspection work, as well as in food industries. Thin for greater finger-tip sensitivity, the lightweight Neoprene Stanzoil glove is said to be tough and durable. Fingers have a non-slip finish. Is designed to resist oils, acids, and caustics. The Pioneer Rubber Company, Willard, Ohio. (Figure 10)

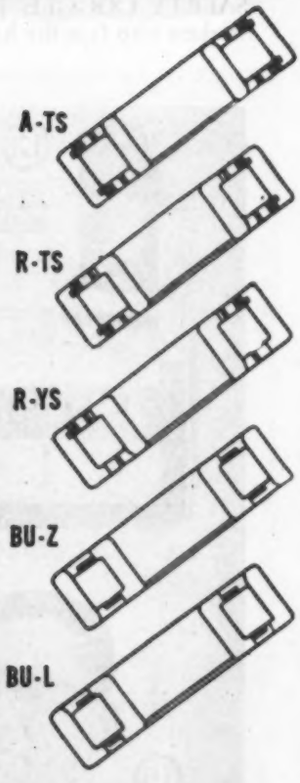
PROTECTIVE GOGGLE—made of plastic shatterproof one-piece lens, re-



Hyatt Hy-Load Bearings are made in separable types as well as in self-contained units. In the separable bearings the inner races are the separable units in one instance and the outer races in the other. Thus, the component parts of every separable Hyatt Hy-Load type bearing of a given size are fully interchangeable. Every race fits every roller assembly.

Separable races may be assembled in one part of the shop and the rest of the bearing in another. When the sub-assemblies are brought together on the final assembly line the component bearing parts will fit correctly. No selection or matching required.

Every Hyatt A-TS, R-TS, R-YS, BU-Z and BU-L type bearing has this feature—and many others. Write for data.



HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION

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placeable at low cost, is claimed to withstand heavy impact, and to be resistant to pitting caused by sparks. Frame is provided with vent-holes to eliminate fogging. Watchemoket Optical Company, Inc., Providence, R. I. (Figure 11)

PROTECTIVE HOOD—lightweight, and air-supplied, is designed to protect workers in paint, chemical, woodworking, metallizing, finishing, and allied industries. Called the "Taeco" hood, it is said to afford safety, comfort, freedom of body movement, and to allow easy replacement of parts. Wesley A. Gibbons Company, Birmingham, Mich.

ROLLING SNACK BAR—serves industrial workers between-meal refreshments right at the job. Has four tiers for sandwiches, pastry, fruits, candy; drawers for soft drinks and juices; straw bin and refuse bin; space for a coffee container. Albert Pick Company, Inc., Chicago. (Figure 12)

SAFETY FACE SHIELDS – are made in three thicknesses, three sizes of cellulose acetate general-purpose windows, and three sizes of 24-mesh screen windows for heat protection. A fiber front is available for scarfing and welding. Bover-Campbell Company, Detroit. (Figure 13)

SAFETY GOGGLE—is designed for workers who face the hazards of flying objects. Increased ventilation and greater comfort are effected by air channels in the edge of the eyecups, and fogging is prevented by extra side perforations. They are said to be non-conductors of heat and electricity. American Optical Company, Southbridge, Mass. (Figure 14)

SAFETY GOGGLES—rugged in construction, with strong, massive front, have deep lens groove in rims to resist effects of impact. Bridge has face contour for added protection, and nose pads are designed to withstand jolts and blows. Made of acetate, they are recommended for the "mental-allergic" worker. American Optical Company, Southbridge, Mass. (Figure 15)

SALT-TABLET DISPENSER – that can be thrown away when empty is designed to save cleaning and refilling time. Equipped with plastic brackets for fastening to the wall. "Pep-up" salt tablets are enteric coated to prevent salt sickness and heat fatigue. United States Safety Service Company, Kansas City, Mo.

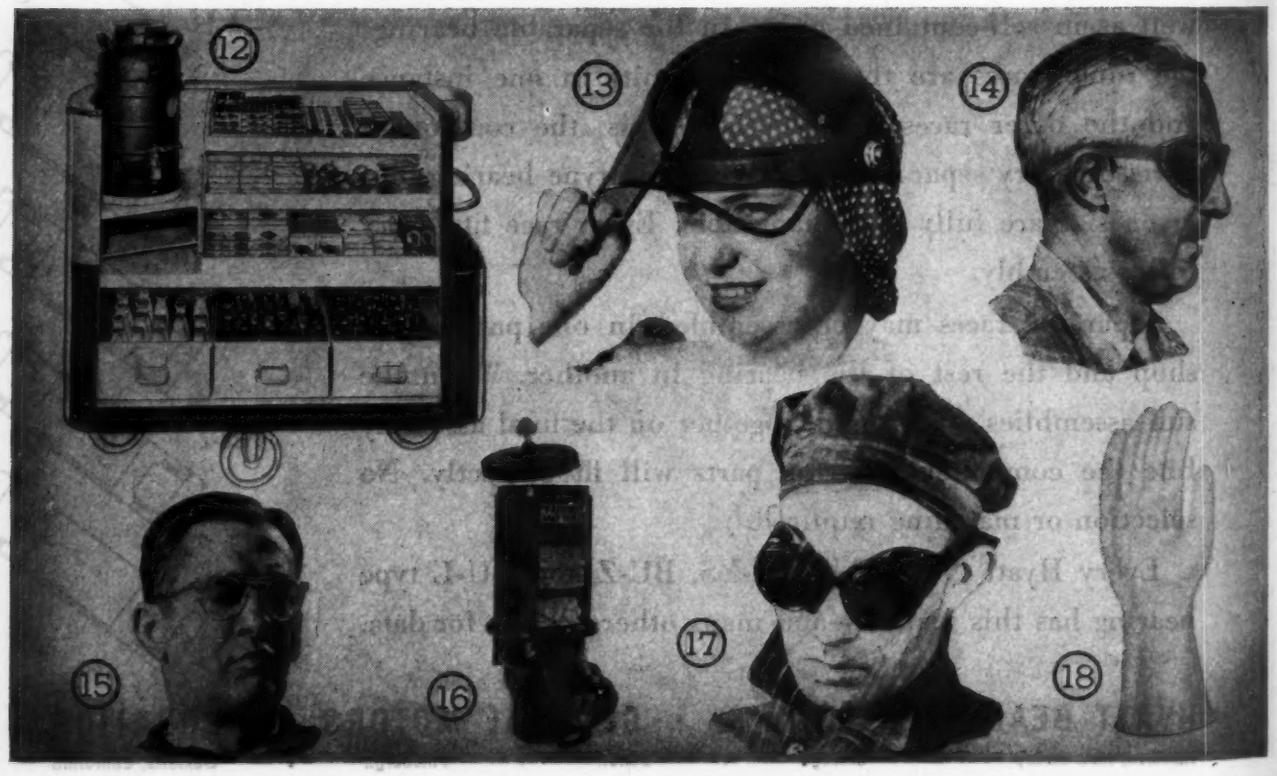
SALT-TABLET DISPENSERS – are of plastic, have transparent discharge covers to prevent dropping and contamination of tablets, and eliminate wastage from over-drawing. Lock-top and key prevent tampering. Condensation is discouraged by all-plastic construction. Standard Safety Equipment Company, Chicago. (Figure 16)

SKIN CREAM—made in two types, for dry and for wet working conditions, is named "Clad." The dry type is reported to protect the skin against dirt, grease, grime, and other hard-to-wash-off substances; the cream for wet use protects the skin against water and other dilute aqueous and mild chemical solutions. The B. F. Goodrich Company, Akron, Ohio.

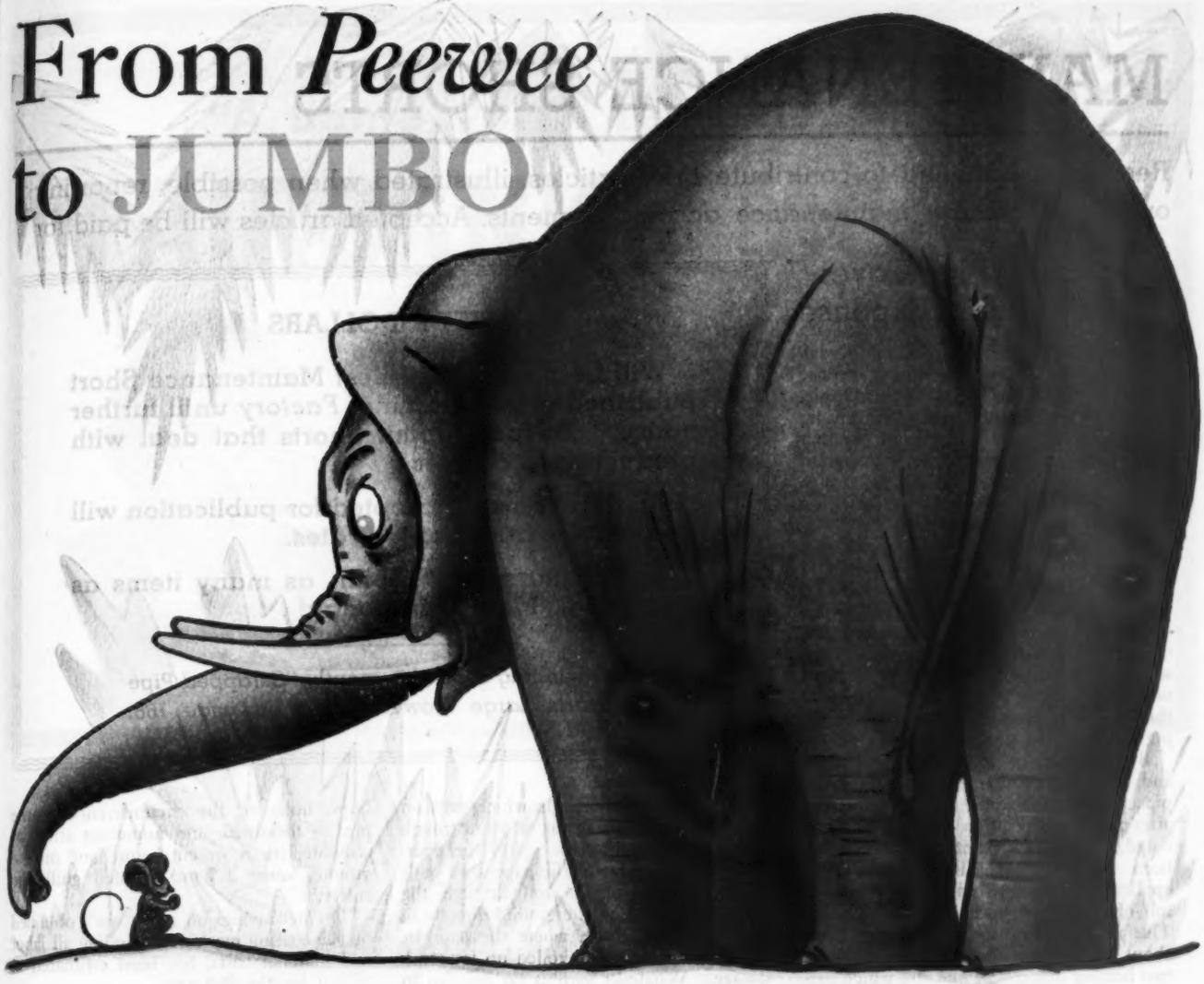
WELDING GOGGLE – known as AO Model 404A Duraweld has eyecups molded to fit the eyes, with large, comfortable edges. Louvers of side shields are designed to prevent stray light rays or sparks from reaching the eyes, and to provide increased ventilation for coolness and non-fogging. American Optical Company, Southbridge, Mass. (Figure 17)

WORK GLOVES—of synthetic rubber, made of compound called Whale-Hide, are said to be flexible and resistant to all chemicals and solvents. Suitable for fine work or heavy-duty use. Industrial Products Company, Philadelphia. (Figure 18)

WORK HANDLER—known as Steel Grip Safeguard No. 15096, is two-fingered and open-backed, designed for hand protection. Made of chrome-tanned cowhide split leather, it carries a double thickness across the entire palm and over the side and back of the forefinger. Industrial Gloves Company, Danville, Ill.



From *Peewee* to JUMBO



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Will be paid for the best Maintenance Short published in each issue of *Factory* until further notice. (Do not submit Shorts that deal with production processes.)

All other Shorts accepted for publication will be paid for at attractive rates.

Contributors may submit as many items as they wish. Mail yours today!

Prize-winning short this month, "Scrapped Pipe Supports Large Blower Duct," on page 166.

Precoating Pipe Cover Saves Painting Expense

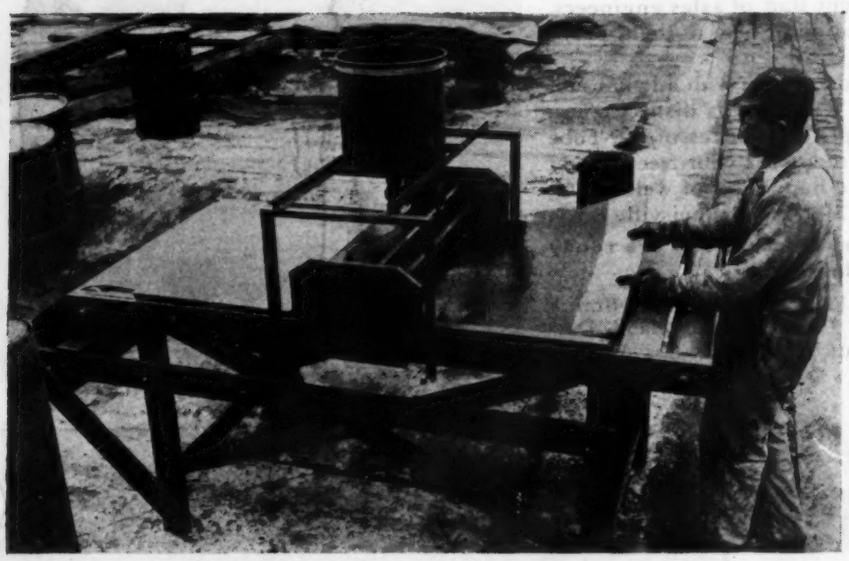
In the Kodak Park plant of Eastman Kodak Company all insulated outdoor service pipes and tanks for air, ammonia, brine, and steam are wrapped with roofing paper to protect the insulation against weather deterioration. To aid in the preservation of this roofing paper it was the practice to paint the paper and metallic bands with a tar preparation after installation.

In repairing pipe covering, which was usually done during the good weather of summer months, it was never possible to follow up immediately with painting because of the heavy demand for painters during summer departmental shutdowns. Consequently the cost of painting of repaired outside lines was always high because of the expense of placing ladders and scaffolding to reach the pipelines.

By painting the rolls of roofing paper and bands before their application by the pipecoverers, the difficult and expensive after-painting operation has been eliminated. A special painting machine has been contrived for this purpose, which applies a solid, even coat of tar on a full roll of roofing paper in about 2 minutes. This machine consists of a wooden table about 40 inches wide by 8 feet long, with two bearing brackets at one end which support a removable round bar to hold the untreated roll of paper. Across the center of the table is a V-shaped trough into which the tar preparation is fed from a pail with valved outlet supported by framework above the trough. To process the roofing paper, the edge of the paper roll is threaded under the trough, which rests on it. When the flow of tar into the trough is begun by opening the valve, the operator grasps the edge of the paper and pulls the full length of the roll through the machine and out on the ground directly in front of the machine, where the paper is left until dry and then rolled up for stock storage. Whatever surplus tar remains in the trough after the full roll passes through the coating machine drains into a reservoir directly under the V-slot, for reclamation.

Further economies are obtained by the pipecoverers who used to cut the paper roll high on the job with a hand-shears. This was a difficult and tiring operation. Now, however, the circumference of the pipe is measured, and numerous strips of accurate length are cut beforehand on the ground, using a hand-operated guillotine cutter.

The net savings on repair work obtained by the coating machine, including all labor and material costs, has been estimated at $2500 for the first year.



Special painting machine applies a solid, even coat of tar to pipecovering, saving painters' time and the expense of erecting ladders and scaffolding

•

Lead Casting Solves Acid Pump Problem

CHARLES E. APEL, Maintenance Engineer, Globe-Union, Inc., Atlanta, Ga.

Users of rotary pumps for handling sulphuric or other strong acids may find that a lead nut on the impeller shaft may solve a serious problem, as it did for us.

Recently, the nut on one of the impeller shafts in our plant disintegrated, and it was impossible to obtain quickly another nut of acid resisting material. A steel nut would have given service for only about 48 hours.

We cast a lead nut around the shaft and since then have had no trouble with the impeller coming loose on the shaft.

•

Removing Chips From Milling Machines

A compressed air attachment for removing chips from extrusion milling machines has been developed as a result of employee suggestions at the Glenn L. Martin Company, Baltimore. With this attachment,

"A name worth remembering"

FAIRBANKS-MORSE

Fairbanks-Morse postwar products will serve you with the *dependability* the world has come to associate with our name. Designing and manufacturing skills will not have to be re-learned in our plants as we turn to civilian production, because as a part of our war job, we've continued to build and improve our peacetime Diesel engines, generators, motors, pumps, and scales.

C. H. Morse Jr.
General Sales Manager

Fairbanks-Morse Pumps are famed for their power-saving efficiency... and for mechanical advantages which cause them to retain that efficiency through long, trouble-free lives. The line is complete—includes centrifugal, split-case centrifugal, built-together, angle-flow, power, rotary, turbine, propeller, paper stock, sewage, trash, and many other types, all in a full range of capacities.

PUMPS

FAIRBANKS, MORSE & CO.
CHICAGO 5, ILLINOIS

Diesel Locomotives • Diesel Engines
Scales • Generators • Motors • Pumps
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

BUY MORE WAR BONDS

Portable receptacle catches chips swept from the milling machine by twin jets of air. Prior to the invention of copper tubing attachment to direct the air current, flying chips clogged the machine and littered the floor

twin jets of air are directed on each side of the milling cutter by copper tubing. The air current carries the chips into a duct attached to the machine, and they pass from the end of the duct into a mobile receptacle.

Prior to this invention, it took all the time of one worker to brush the chips from the bed of the milling machine. Today, this man is relieved for other duties.

The sanitation department no longer has the task of sweeping up chips that formerly covered the floor. Scrap is segregated at the source for the conservation department and the chips are not contaminated by dirt or mixed up with chips of other metals.

Old Belting Protects Sandblast Cabinets

B. A. PARKS, Maintenance Engineer, Crane Company, Chicago

Any metal on which a sand or shot blast impinges is rapidly eroded. Naturally the sheet-metal sides of the blast cabinet or room are the principal sufferers. Time was when our sheet metal department was on the jump most of the time replacing sheet-metal panels in the sandblasting room.

Then someone came up with the bright idea of lining the walls or sides with old lumber. This change was an improvement, in that the wood lasted somewhat longer than the sheet metal, but it just shifted the maintenance job from sheet metal department to carpenter shop.

Eventually someone noticed that we had a large amount of old rubber-covered conveyor belt, which had little salvage value, and the idea occurred to him of using this old belting for lining the blast cabinets and rooms. It was just the right answer. The old belting has remarkable resistance to abrasion from the sand or shot blast, hence repairs to the sheet-metal sides of the blast cabinets or rooms is now a very small item.

As a result of this experience, other similar uses for old conveyor belting have come to light. For example, dust-collecting cyclones used to wear out rapidly, where the dust is of abrasive nature, but by lining the interior of the cyclones, particularly the cone, with the old rubber-covered belting the life of the sheet metal is prolonged almost indefinitely.

Scrapped Pipe Supports Large Blower Duct

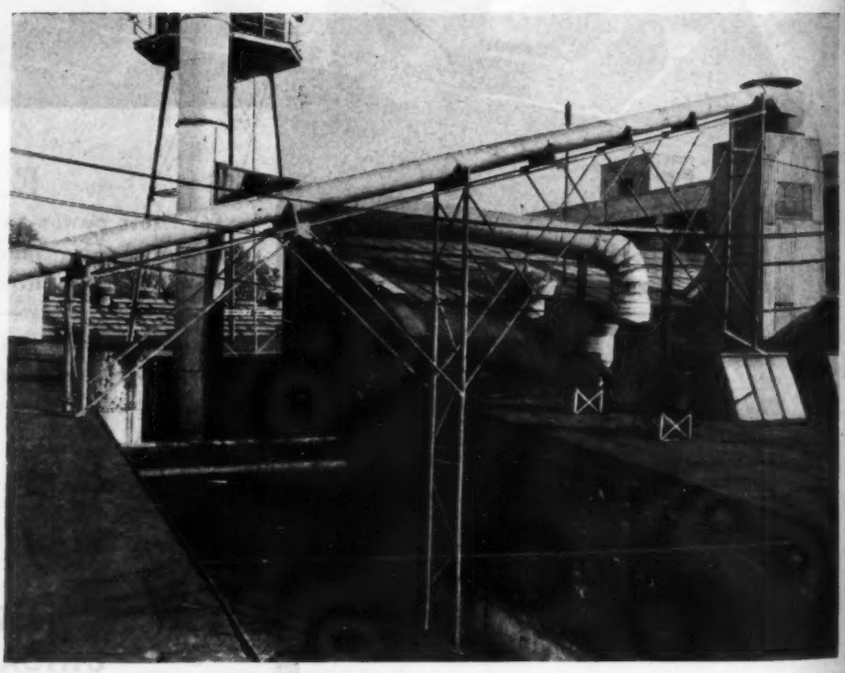
ROBERT T. SCOTT, Maintenance Superintendent, New Idea, Inc., Coldwater, Ohio

Confronted with a scarcity of timbers and structural steel when we needed to rebuild the supports for a 75-ft. section of 18-in. sheet-metal blower duct, 25 to 60 feet above the ground, we solved our problem by using sections of scrapped 4- and 1½-in. steel pipe, welding it as needed to fit the purpose.

Supports for the duct, which carries shavings and sawdust from a blower in a woodworking building to a cyclone on the power plant roof, were in need of immediate attention, and we considered ourselves fortunate in finding the scrap pipe to rebuild them. We had recently replaced a number of 4-in. by 21-ft. flues in one of our boilers, and a considerable amount of 1½-in. pipe previously used as a heating coil for a warehouse was available.

Accordingly, we used the 4-in. pipe for vertical supports, and welded sections of the smaller pipe to it, as braces. The smaller pipe also was used to build a trusswork, in combination with some oak planks cut to serve as cradles.

The finished structure is strong, and with regular painting should last as long as though it were made of new materials.



Sections of 4-in. boiler pipe and 1½-in. heating coil pipe which had been scrapped, were joined by welding to form the supports of a 75-ft. blower duct, installed at New Idea, Inc., Coldwater, Ohio

NEW BRITAIN MACHINED

At this very moment Allied artillery shells are reaching their targets all over the world with deadly accuracy . . . an unequaled performance made possible by American men, women and machines producing precision-built firing power and ammunition. • New Britain Automatics remain on the job in turning out essential parts for projectiles and other war materials and equipment . . . machines designed to withstand present day production demands and engineered to stay accurate . . . now and postwar. • New Britains produce more . . . better and faster . . . for less.

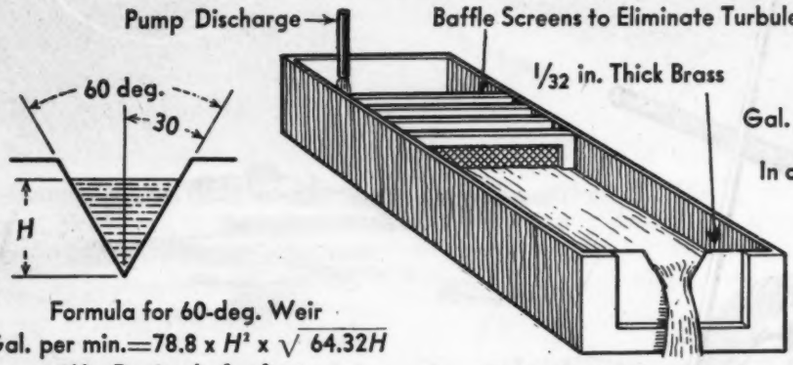
NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY • NEW BRITAIN, CONNECTICUT

NEW BRITAIN-GRIDLEY MACHINE DIVISION

Use of Weir Gage to Measure Pump Capacity

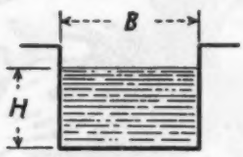
THE TABLE BELOW gives the flow of water in gallons per minute for 60-deg. and rectangular weir gages. Temperature of the water is assumed to be 60 deg. F. Output of the pump is discharged into a weir box constructed as shown. Dimension *H* is measured at least 6 inches back of weir plate by a scale graduated in tenths of an inch.



Typical Weir Construction

Formula for 60-deg. Weir
Gal. per min.=78.8 x H^2 x $\sqrt{64.32H}$
H=Decimal of a foot

Formula for Rectangular Weir
Gal. per min.=1494.504 $(B-0.2H)\,H\sqrt{H}$
H and *B*=Decimal of a foot.
In calculating the chart, dimension *B* was assumed to be 7 inches.



		60-deg. Weir	Rect. Weir			60-deg. Weir	Rect. Weir			60-deg. Weir	Rect. Weir
Inches	Feet(*H*)	Gal. per min.	Gal. per min.	Inches	Feet(*H*)	Gal. per min.	Gal. per min.	Inches	Feet(*H*)	Gal. per min.	Gal. per min.
0.1	0.008		0.6	2.1	0.175	8.1	59.9	4.1	0.342	43.1	153.7
0.2	0.017		1.8	2.2	0.183	9.1	64.1	4.2	0.350	45.8	158.8
0.3	0.025		3.4	2.3	0.192	10.2	68.3	4.3	0.358	48.6	164.0
0.4	0.033		5.2	2.4	0.200	11.3	72.6	4.4	0.367	51.5	169.2
0.5	0.042		7.3	2.5	0.208	12.5	76.9	4.5	0.375	54.4	174.4
0.6	0.050	0.35	9.5	2.6	0.217	13.8	81.4	4.6	0.383	57.5	179.7
0.7	0.058	0.52	12.0	2.7	0.225	15.2	85.8	4.7	0.392	60.7	185.0
0.8	0.067	0.72	14.6	2.8	0.233	16.6	90.4	4.8	0.400	64.0	190.3
0.9	0.075	1.0	17.4	2.9	0.242	18.1	94.9	4.9	0.408	67.3	195.6
1.0	0.083	1.3	20.3	3.0	0.250	19.7	99.6	5.0	0.417	70.8	200.9
1.1	0.092	1.6	23.4	3.1	0.258	21.4	104.3	5.1	0.425	74.4	206.3
1.2	0.100	2.0	26.6	3.2	0.267	23.2	109.0	5.2	0.433	78.0	211.7
1.3	0.108	2.4	29.9	3.3	0.275	25.1	113.8	5.3	0.442	81.9	217.1
1.4	0.117	2.9	33.3	3.4	0.283	27.0	118.7	5.4	0.450	85.8	225.5
1.5	0.125	3.5	36.8	3.5	0.292	29.0	123.5	5.5	0.458	89.9	228.0
1.6	0.133	4.1	40.5	3.6	0.300	31.1	128.5	5.6	0.467	94.0	233.4
1.7	0.142	4.8	44.2	3.7	0.308	33.5	133.4	5.7	0.475	98.3	238.9
1.8	0.150	5.5	48.0	3.8	0.317	35.6	138.4	5.8	0.483	102.6	244.4
1.9	0.158	6.3	51.9	3.9	0.325	38.0	143.5	5.9	0.492	107.0	249.8
2.0	0.167	7.2	55.9	4.0	0.333	40.5	148.6	6.0	0.500	111.7	255.3

Prepared by Pioneer Pump & Manufacturing Company, Detroit

"A.W." SUPER-DIAMOND
RESISTS SLIPPING IN ANY DIRECTION

Sure footing means fast loading . . . and fast loading means time saved . . . Sure footing with "A.W." Rolled Steel Floor Plate—for workers in industrial plants, refineries, railroads, on ship-board. "A.W." Rolled Steel Floor Plate is fire-proof, heat-proof, oil-proof, crack-proof. Toughest wear will not damage it. Can be installed almost overnight without disturbing production. Write for folder.

Other "A.W." products include:
Plates, Sheets, Billets, Blooms, Slabs—Carbon, Copper or Alloy analyses.

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MAIN OFFICE AND MILLS: CONSHOHOCKEN, PENNSYLVANIA : SINCE 1826. District Offices and Representatives: Philadelphia, New York, Boston, Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, St. Paul, New Orleans, Pittsburgh, Roanoke, Sanford, N. C., St. Louis, Los Angeles, San Francisco, Seattle, Montreal.

Extra Long Life

● The performance and the service that you gain from your electric motors depends to a very great extent on the bearings you install. Quality should be your first thought when purchasing bearings—either for new equipment or for replacement.

Johnson Electric Motor Bearings are the highest quality available. Cast in a special high-lead bronze alloy they deliver the smoothest performance for the greatest period of time. The plastic quality of this alloy permits a reasonable amount of overloads, misalignment, and prevents grit from scoring the shaft.

Johnson Electric Motor Bearings are usually available from stock for over 250 different types of motors. Each bearing is completely machined to the correct tolerances . . . ready for immediate installation. Oil holes, slots or grooves are in accordance with the requirements of the motor.

The next time you need bearings, specify Johnson Bronze. Test them in comparison with any you have ever used. See for yourself the extra service and performance you gain.

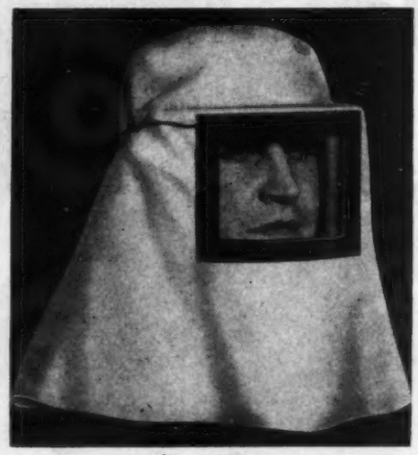
JOHNSON BRONZE CO.
512 SOUTH MILL ST.
NEW CASTLE, PA.

Specify JOHNSON BRONZE

WHAT'S NEW IN EQUIPMENT

Dust Hood

Lightweight hood, claimed to offer full vision and practicability against fine nuisance dusts, is announced. Style GG-300 is constructed of cotton sheeting over a cloth cap, with fiber frame window opening 5x6 inches in size. Window of cellulose acetate plastic is easily replaced when necessary. Tape tie inside bottom hem can be used for pulling close to the neck. Industrial Products Co., 2820 North 4 St., Philadelphia 33.

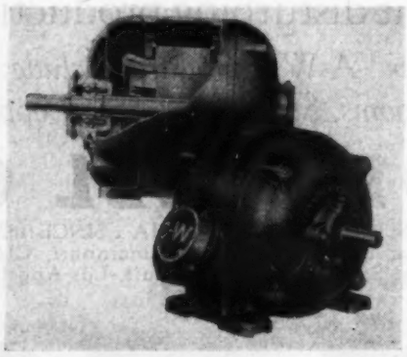


Wood Plastic

A wood plastic is said to be waterproof, subject to less shrinkage and to take nailing, planing, sawing, and screwing, keeping soft and workable for years. It is available in a neutral shade that can be finished in any desired color. Comes packed in 5-gal. and drum sizes. So-Lo Works, Inc., Loveland, Ohio.

Electric Motor

Protected-type motor is said to combine the surplus capacity of conventional open motor with protection against dripping liquid, falling metal chips, and other foreign matter. Rated 40-deg. C. rise, full-load continuous duty, with a 15 percent service factor, motors are available in sizes up to and including the No. 284 frame. Mounting dimensions conform to NEMA standards. There are no openings in the frame or shields above the horizontal center line, and ventilating openings are shielded. Centrifugal seals permit use of softer grease for better lubrication and longer bearing life. The company's "Alucast" rotor construction, in which the bars, fans, and end rings are cast in one operation from aluminum alloys, is employed. Other features include heavy cast frame construction, coils protected by vinyl acetal insulation, interchangeable front and rear shields, and guides for directing cooling air over all surfaces. Crocker-Wheeler Div. of Joshua Hendy Iron Works, Ampere, N. J.



Split-Leg Apron

To take the place of overalls, but at the same time furnish as much clothes protection, a split-leg apron is announced, under the trade name "Canpro." Easier to slip on and off than overalls, it furnishes the "around-the-leg protection" that is important in handling kegs and boxes. Made from heavy O.D. water-repellent canvas, the apron is doubly reinforced at the midsection and at the knees, and has pockets that cannot pull loose. Extends far below the knees and is said to be comfortable to wear. Canvas Products Corp., Fond du Lac, Wis.

Steam Jet

"Weldco" steam jet for pickling tanks and water rinse tanks is a combination mixer and agitator. Power, generated by steam swishing forth into the solution in a broadening diameter, circulates the pickling liquid in a continuous cycle, heating and

ONLY *Leather Belting* CAN DO THIS JOB PROPERLY

"INDUSTRY LEARNS BEST FROM EXPERIENCE"

A 10" heavy two-ply endless Leather Belt is used with this 50 horsepower induction motor mounted upon pivoted motor base to drive a large ventilating supply fan in Gimbel Bros. Department Store, Philadelphia. Some of the Leather Belts in use in this store have already seen over 20 years' continuous service. Their average age is over 10 years.

Leather Belting is Best for You, Too . . . and HERE'S WHY

The huge Gimbel Bros. Department Store in Philadelphia was one of the country's first big stores to make mechanical ventilation available for its customers. Such equipment must be utterly dependable, day and night. Mr. I. S. Fister, Plant Engineer, says: "Leather Belting gives a more even and shock-proof drive than any other belting material."

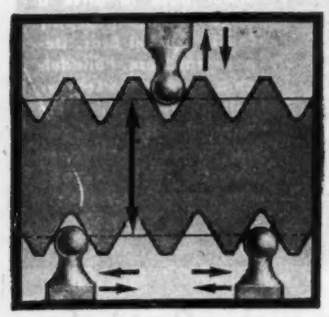
Experienced Engineers everywhere recognize that the higher coefficient of friction of Leather Belting gives it a better pulley-gripping capacity that *increases* as the load is increased.

LEATHER BELTING IS TOUGH AND RELIABLE —IT ACTUALLY IMPROVES WITH USE!

AMERICAN LEATHER BELTING ASSOCIATION • 41 Park Row, NEW YORK 7, N. Y.

Positively, More Accurately and to closer tolerances

MODEL 45B-100. The upper, sensitive roller contact actuates the Dial Indicator.



MODEL 45B-80. The upper, sensitive ball contact actuates the Dial Indicator. Both lower ball anvils float sidewise independently to compensate for any variation in lead.

No conventional type of gage, whether ring gage or roller-type snap gage, can tell you so **definitely** and so **quickly** the degree of accuracy of a pitch diameter as these two types of Dial Indicator Gages. Neither depend upon the uncertain sense of touch.

The roller type tells more than the conventional roller snap gage because the sensitive upper roller contact, reveals on the Indicator, just **how much** and **where** the pitch diameter may be wrong. The ball type simulates the three-wire method, but is faster. It is accurate to a tenth of a thousandth. Either type is incorporated in the adjustable Dial Indicator Gage shown below. For details write—

TWO FULL COLOR FILMS
(With Sound)
No. 1 DIAL INDICATORS
No. 2 DIAL INDICATOR GAGES
20 minutes each. For instruction and training. For showing write

FEDERAL PRODUCTS CORPORATION
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PRECISION MEASURING INSTRUMENTS

DIAL INDICATOR TRUISM—
Feeling a measurement is Relative
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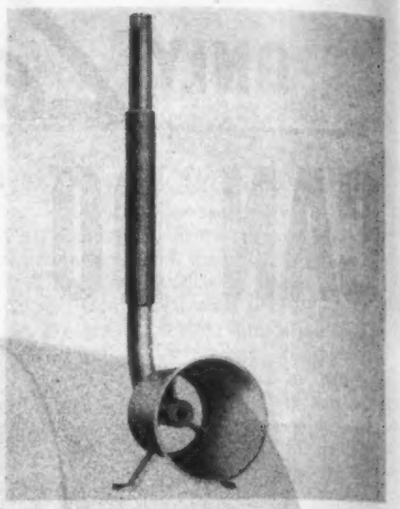


agitating the pickling acid. Maintains pickling solution uniformity throughout the length and breadth of the tank. Made of wrought monel and welded with monel electrodes, making the entire jets virtually one solid piece, they are claimed to be breakproof, although they will bend under considerable impact, and can be straightened out. The jets can be attached to steam line without any auxiliary equipment or fittings; placed along the wall or in corners of tanks; suspended along the side or in the center; or may have a through-the-wall installation. The Youngstown Welding & Engineering Co., Youngstown 9, Ohio.

Wrench Holders

Set of wrench holders, each accommodating four progressive sizes of wrenches for all makes of hollow head socket screws, is announced. Four holders cover all screws from No. 4 to 1½ inches. Wrenches can be changed in the holder to use the short

or long end of the wrench. Advantages claimed by the manufacturer are: (1) Holders keep a complete set of wrenches ready for use, because there is a particular slot for each size wrench; (2) wrench is easy to use in holder; (3) selecting wrench of proper size to fit a socket is easy and speedy. The Micro Tool Co., 24 Sigourney St., Hartford 5, Conn.

Building Panels

"Fenestra" metallic building panels can be used to sheath the floors, walls, partitions, and roofs of virtually all types of buildings, according to the manufacturer. Panels provide both framing and covering material in a single unit, and in some types

MASTER GEARHEAD MOTORS

COST REDUCED by the elimination of bearings, couplings, chains, and sprockets, gear trains or separate gear reducers . . . only one unit to mount . . . lower assembly costs.

COMPACT. High reduction ratios secured in small space by using heat treated special alloy steels for both splined shafts and gears.

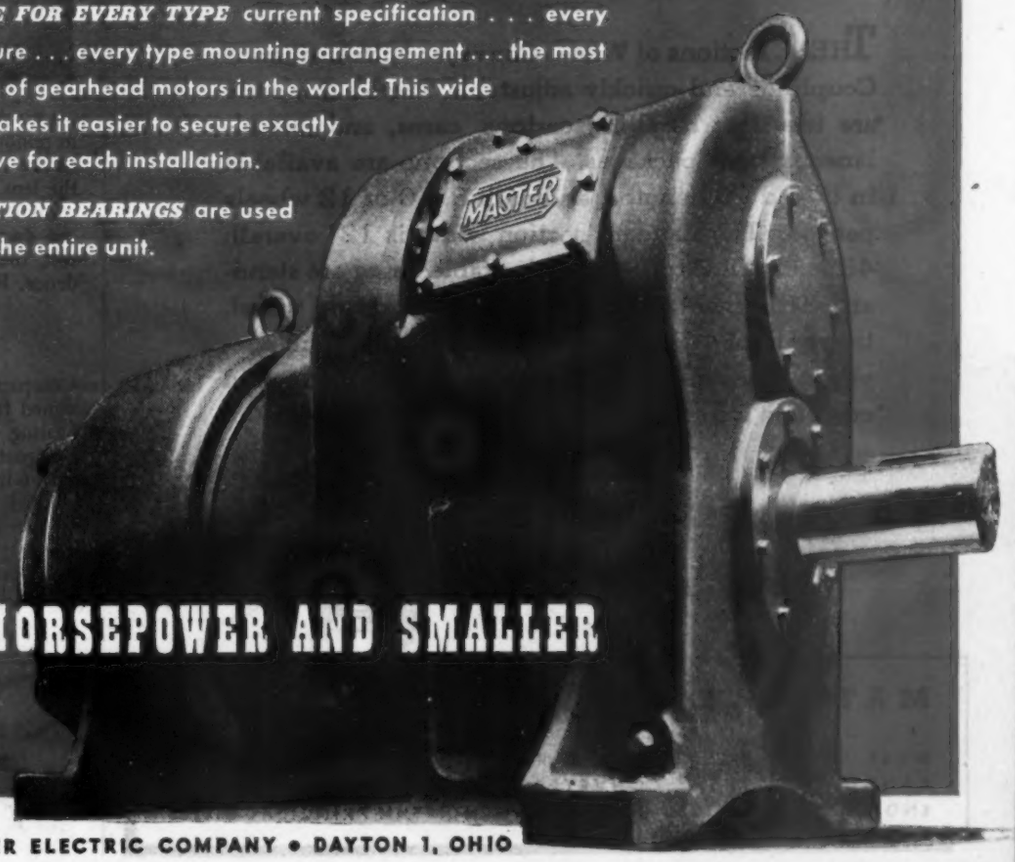
HIGHER EFFICIENCY than other types of slow speed drives . . . only 2 percent power loss in each stage of gear reduction, in parallel shaft types.

SIMPLIFIED DESIGN. More compact . . . less weight . . . permanent alignment . . . fewer moving parts . . . high efficiency . . . longer, reliable, trouble-free operation.

INTEGRAL CONSTRUCTION. Both motors and gears are designed, built, and guaranteed by one organization as a well balanced power package.

AVAILABLE FOR EVERY TYPE current specification . . . every type enclosure . . . every type mounting arrangement . . . the most flexible line of gearhead motors in the world. This wide flexibility makes it easier to secure exactly the right drive for each installation.

ANTI-FRICTION BEARINGS are used throughout the entire unit.



100 HORSEPOWER AND SMALLER

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

MATHEWS *Flexible* WHEEL CONVEYER

THESE sections of Wheel Conveyer with Universal Couplings and quickly adjustable Tripod Supports are ideal for handling cartons, cases, and miscellaneous light packages. The sections are available in 5′ and 10′ lengths, and with 8, 10 or 12 wheels per foot. The standard section width is 12″ overall. 45° and 90° Curves with adjustable guard are standard. The wheel used is a high-quality skate wheel, the result of 40 years of Mathews experience in conveyer bearing and wheel manufacture. Prices and complete information sent on request.

MATHEWS CONVEYER COMPANY
Ellwood City, Pa.
WEST COAST • MAILLER SEARLES, INC., SAN FRANCISCO
CANADA • MATHEWS CONVEYER CO., LTD., PORT HOPE, ONT.
ENGINEERING OFFICES OR SALES AGENCIES IN PRINCIPAL CITIES

offer added advantages of insulation and soundproofing. Design of the units provides smooth, flat panels of sheet metal complete with channel-type ribs, assembled at the factory. Available in a variety of types and a range of sizes. Installation is said to be quick and easy, with a substantial saving in labor. When used for floors, the building panels can be used to replace joists and rough flooring under either wood or concrete floors. Provide long-span roof deck in 20 to 25 foot lengths. Wall and partition panels can be load-bearing in some types of structures. Detroit Steel Products Co., Building Panels Div., Detroit 11.

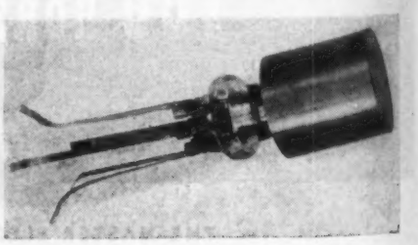
Fog-Free Goggle

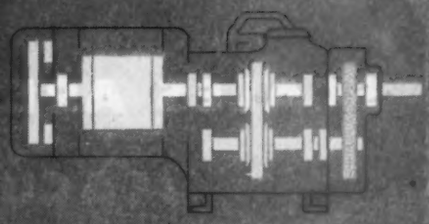
Normal breathing has been harnessed to provide a natural ventilating pump for the "fog-free, dust-free" goggle by sweeping a complete change of air (about once every second) through flow channels in the frame and across the inner face of the

big single plastic lens. This action is said to remove moisture from within the goggle before it can condense as fog or frost on the lens. In addition, the air intake ports contain replaceable felt filter pads to filter out dust and flying particles, and to protect the eyes. Welsh Mfg. Co., Providence, R. I.

Power Tube

Compact power tube, first in a series designed for industrial use in high-frequency heating equipment, has been announced. Designated F-5303, the tube is supplied with 6-in. flexible copper leads permanently secured to the tube terminals. This feature is claimed to eliminate the glass damage frequently encountered by industrial users in attaching and adjusting terminal clamps on the tube itself, and to





Stepless VARIABLE SPEED operation offers tremendous advantages on many applications. A superior quality product and increased production will result in nearly every case.

Thousands of alert engineers, like you, have found that the best way to secure these advantages is with Master Speedrangers . . . the compact, all metal units of proven reliability.

For example, look at the ring grinders shown below. The Speedranger, on the drive unit, by incorporating also a gear reduction on one end and an electric brake on the other end . . . all designed and built into one compact integral power drive . . . provides variable speed, at exactly the right range. In addition, the machine can be quickly stopped and started again for increased production.

The other Speedranger provides smooth, stepless, variable speeds from 600 to 5000 RPM for the grinding wheel.

Each Speedranger mounts neatly on the machine, saves space, saves money, and greatly improves the output, appearance, and convenience of the equipment.

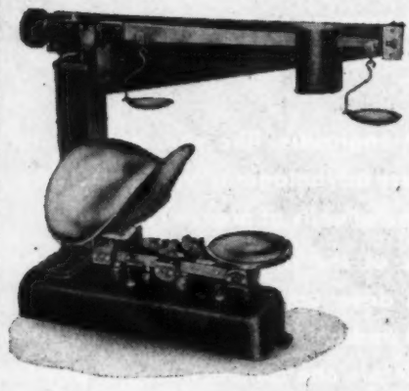
Probably you will not need this same combination of features. However, the next time you need a drive for material processing, handling, and conveying equipment; mixers and agitators; weld-positions; machine tool drives; testing and calibrating equipment . . . to name only a few . . . see what a really remarkable job Master Speedrangers can do for you.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

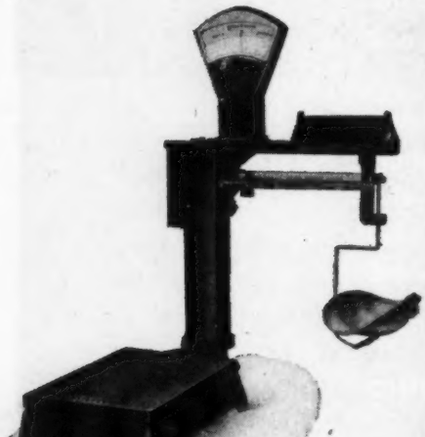
MASTER SPEEDRANGERS

SCALES ARE INDUSTRIAL MACHINERY

Let a DETECTO-GRAM SCALE engineer check your scales for accuracy! You may be robbing yourself or your customers—an inaccurate scale is *dangerous* either way. Let the DETECTO-GRAM SCALE ENGINEER check your scales for utility. So many plants use scales as a production technique—you may be missing a bet. For the right scale in the right job and hairline accuracy, insist on DECTECTO-GRAM SCALES.



WHEN YOU COUNT BEFORE PACKAGING USE NO. 66-02



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SCALE ENGINEERS IN ALL PRINCIPAL CITIES

permit installation and maintenance by inexperienced personnel. It is said to have sturdy, conservatively spaced filament and grid elements, and an absence of ceramic insulation, both internal and external, to make it suitable for use in electronic heating equipment that must withstand the shocks and vibration encountered in plant operations. Rated at 3500 watts input, tube operates at full ratings at frequencies up to 50 megacycles, according to the manufacturer. Federal Telephone & Radio Corp., Newark, N. J.

Consolidation

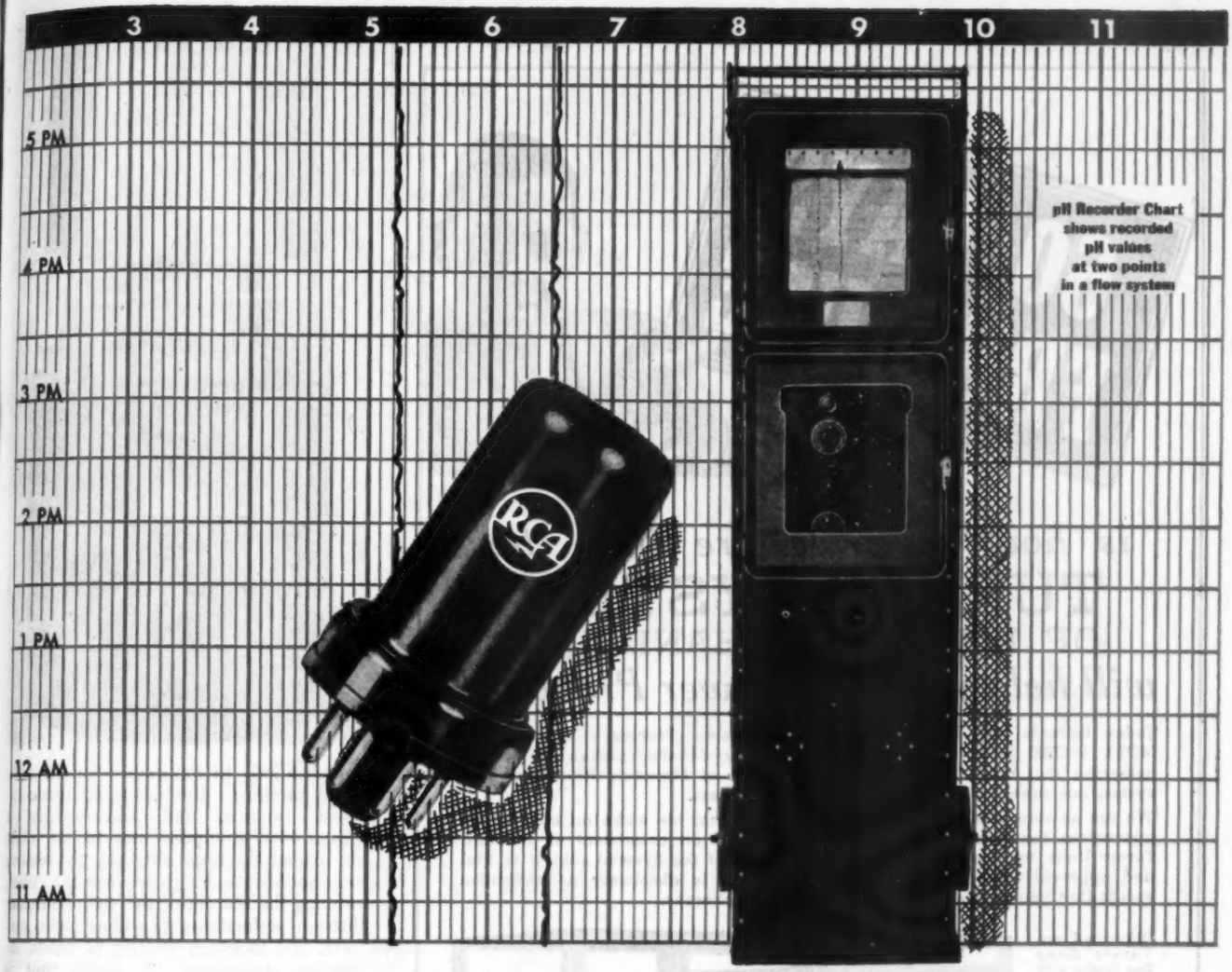
Faraday Electric Corporation, Adrian, Mich., announces the acquisition of the Holtzer Cabot Electric Company, combining this signal system business with its Stanley Patterson Division. Manufacturing will be done in Adrian, Mich., and Chicago, Ill.

Ground Resistance Tester

Model 255 "Vibroground," a low and high ground electrical resistance tester, is claimed to give accurate readings for all ground conditions, and to be particularly adapted to arid or wet regions or where extremes of dryness or moisture are found. The tester has four ranges—0-3, 0-30, 0-300, 0-3000 ohms. Comes complete with self-contained power supply which eliminates hand cranking. With its direct readings no calculations are said to be necessary. Reverse readings are unnecessary and polarization errors cannot occur. The design also excludes strays from high potential networks, d.c. ground currents, or any a.c. commercial frequencies. The welded metal case is water-tight. Associated Research, Inc., 231 South Green St., Chicago 7.

Dehumidifier

Known as "Water-Sorber," dehumidifier is said to dry the air in warehouses, toolrooms, stockrooms, vaults, basements, and other confined spaces, preventing dampness, mold, and mildew. Three receptacles arranged one below the other catch the residue liquid in descending stages, and permit this liquid (which also contains ac-



How RCA Tubes Help Test Chemical Solutions

Cambridge Instrument Company's Electronic pH Recorder Warns of Adjustments Needed to Prevent Corrosion and Waste.

CONTROL of acidity or alkalinity in many industrial processes should be immediate, and must be held within specified limits throughout the process in order to prevent corrosion and obtain uniform products.

Ordinarily, samples of the solution are taken at various points in a flow system, analyzed in the laboratory, and the process is adjusted accordingly. But this takes time and offers only a limited accuracy of control . . . with the possibility of human error.

Exit test tubes . . . enter RCA electron tubes!

The electronic pH Recorder developed by the Cambridge Instrument Company, utilizing RCA Tubes, determines and records graphically at a central location the pH value of a solution at several different points. (The pH value of a solution is a number indicating hydrogen ion concentration and, therefore, the degree of acidity or alkalinity of the solution.)

How It Works: In the electronic pH recording system, a glass electrode is immersed in the solution at each point to be measured. The ion concentration, or pH, of the solution produces an electrical potential between the electrode and the solution. Measurement of this minute potential . . . made possible by RCA amplifier tubes . . . indicates the pH of the solution. As many test electrodes can be used as are needed to give accurate, continuous control of the pH of the entire flow system. The electrodes are connected electrically to the central control point, which may be located anywhere.

Applications: The electronic pH recorder makes possible accurate control of the acidity of boiler water feed, corrosion in oil refineries, carbonation in sugar refineries, fermentation in breweries and distilleries, and at numerous stages in the manufacture of paper and textiles.

For Further Information on the electronic pH recorder, write to the Cambridge Instrument Co., Grand Central Terminal, New York City. If you have some *other* problem involving the use of electron tubes, RCA tube application engineers will be glad to help you or put you in touch with a manufacturer who can.

For a copy of the free 32-page booklet, "Electrons in Action at RCA," write to RADIO CORPORATION OF AMERICA, Commercial Engineering Section, Dept. 62-51L, Harrison, N. J.

Listen to "THE MUSIC AMERICA LOVES BEST," Sundays, 4:30 P. M., E. W. T., NBC Network

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Today there is only one answer to the Manpower Problem — it is DOING MORE WORK WITH LESS HELP. There is a definite, proven method of achieving that result. It is the Turner System of Materials Handling. This system has saved up to 50% of labor cost for others.

We are so sure that it will do as well for you that we make an offer which guarantees that you cannot lose. We will ship an assortment of standard Turner Units (together with complete description of the System) subject to trial and approval or return within 60 days. There is absolutely no obligation except that you assume nominal transportation charges.

Illustrated are Turner Shop Box Racks with shelves, boxes and trays all mounted on Turner Transports, which may be quickly moved or replaced with the Turner Jimmy, or power equipment.

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Write on your letterhead for details of our Free Trial offer and a copy of our book on "The Turner System of Materials Handling." They will be sent immediately.

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tive chemical) to continue to absorb additional moisture. By presenting more exposed surfaces, and consequently a greater total absorption area to the moist air, chemical cubes are said to remove more moisture. Air passes over the cubes, entering the bottom of the cube container through perforations, providing slow, uniform, and thorough melting of cubes, increasing absorption. A single unit is claimed to service from 800 to 1000 cubic feet. General Air Conditioning Co., Oakley, Cincinnati.

Change in Name

Warren Lamp Company has changed its name to Solar Electric Corporation, considering the latter designation more indicative of the expanded list of items manufactured. Corporation officers, financial condition, and policy remain unchanged, and company will continue to operate at Warren, Penn.

Truck Casters

Matched swivel and rigid interchangeable casters are intended for heavy-duty industrial service where loads are up to 1 ton per caster. In the swivel model, all wearing parts are machined of high-grade machinery steel. A large-diameter ball-

IT'S YOUR POSTWAR ELECTRICAL HOME

—See that it works!

THINK of your electrified home to come . . . big and little appliances of all kinds . . . advanced heating . . . air-conditioning . . . better lighting . . . television . . . All fine servants—but they will be handicapped if you give them insufficient electrical capacity.

So often electrical wiring plans are based on *past* electrical experience—a poor guide to the needs of peak loads to come. It's far safer to plan *reserve* capacity in line with the huge future increase in electrical usage. You'll save yourself plenty of grief later in breakdowns and expensive alterations.

Manufacturers! Apply this in terms of industrial equipment in *your* business. The problem's the same. Make sure you have ample electrical capacity to meet the huge future increases in electrical usage sure to come. In plants too, planned wiring will cost a lot less than unplanned wiring.

Before structures get out of the planning stage, it will pay to consult electrical contractor, utility power engineer, plant power engineer. They'll agree that it's always wiser to *Wire Ahead!* 44288

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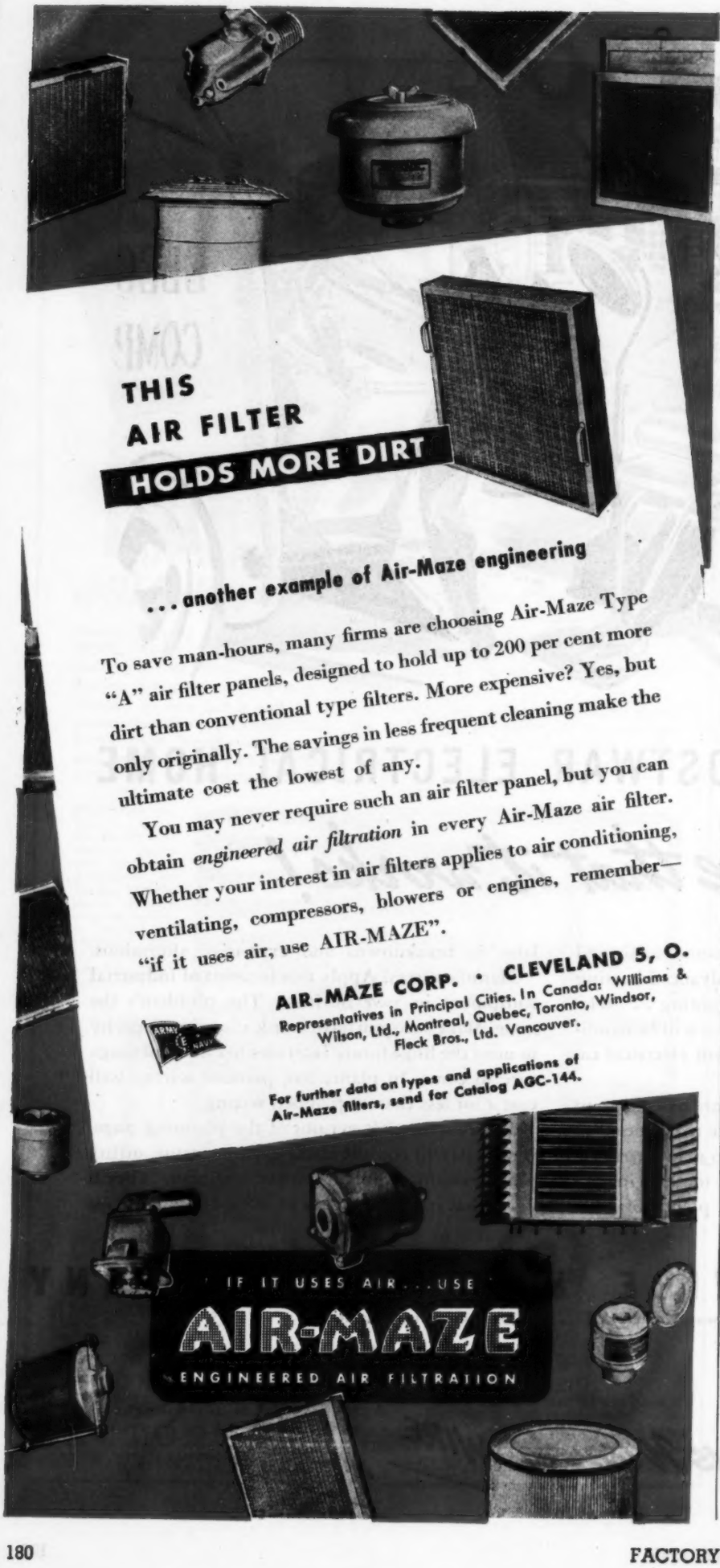
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HOLDS MORE DIRT
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To save man-hours, many firms are choosing Air-Maze Type "A" air filter panels, designed to hold up to 200 per cent more dirt than conventional type filters. More expensive? Yes, but only originally. The savings in less frequent cleaning make the ultimate cost the lowest of any.
You may never require such an air filter panel, but you can obtain engineered air filtration in every Air-Maze air filter. Whether your interest in air filters applies to air conditioning, ventilating, compressors, blowers or engines, remember— "if it uses air, use AIR-MAZE".
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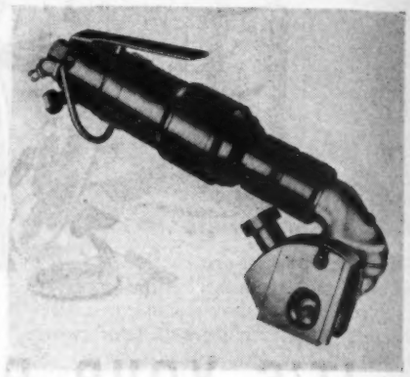
bearing swivel serves as both a thrust and radial bearing. The caster is said to be well protected from dust, dirt, water, and foreign material. Rigid caster is furnished with a heavy steel top plate and formed steel forks welded into a rigid single unit. Wheels on both types run on roller bearings with inner and outer hardened bushings. All types of wheels—rubber, bakelite, steel, semi-steel, and aluminum are available. For corrosive conditions, casters are made of stainless steel or monel metal. Available in wheel diameters of 4, 5, 6, 7, 8, and 10 inches. Market Forge Co., Materials Handling Div., Everett 49, Mass.

Pneumatic Saw

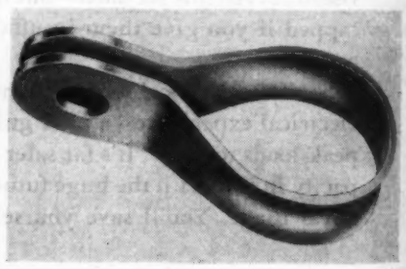
"Cleco" pneumatic baby saw is said to rip metal sheet of steel, brass, or aluminum up to $\frac{3}{16}$-in. thickness. Will cut $\frac{1}{8}$-in. steel at the rate of 1 inch per second, on



a straight or curved line, leaving edges free from burrs. Saw is of heat-treated steel, weighs $2\frac{3}{4}$ pounds, and is about 8 inches long. The Cleveland Pneumatic Tool Co., 3781 East 77 St., Cleveland 5.

Clevis Ring

Clevis ring that can be produced in a simple stamping operation, made to exacting dimensions from alloy steel, and formed to retain the full strength qualities of the



steel, is cadmium plated, and conforms to specification ANQQ-P-421. It fits any standard cable terminal. Poulsen & Nardon, Inc., Terminal Box 2398, Los Angeles 54.

Explosion-Proof Motor

Explosion-proof electric motor has been announced for use with automatic controls in industrial processes where atmosphere containing ethyl ether vapor, gasoline, petroleum, naphtha, alcohols, acetone,

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GENERAL'S *"Part of the Product" Plan*

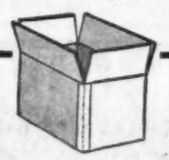
GENERAL Engineered Shipping Containers are designed to the product. Frequently the product and container come off the production line together—as a unit.

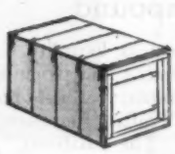
Result: You save space, materials, man-hours and packing costs.

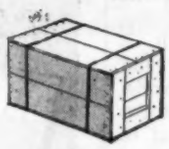
You, too, are mighty PROUD of your PRODUCTS—proud (and rightfully so) of the research, engineering and design which make them better and more useful. So give them the best in product protection—give them GENERAL Engineered Shipping Containers.

Like a doctor's prescription, GENERAL Containers also meet a specific need... they're designed by our engineers to provide support, reinforcement and positive product protection—with a minimum of packing materials. They're actually "A Part of the Product." Thus you save packing materials, reduce handling and shipping costs, and speed production.

While our containers are today shipping vital materials to the fighting fronts, our engineers will be glad to help you with your postwar packing problems. Write today. Get acquainted with GENERAL'S "Part of the Product" Plan. Learn what this plan can do for the *profit side of your business.*


General Corrugated Box


General All-Bound Box


General Nailed Box

General Cleated Fibreboard Container

General Wirebound Crate

Send for your copy of "The General Box." It illustrates our "Part of the Product" Plan.

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Continental Box Company, Inc.: Houston, Dallas.

LUBRICATION IS INDUSTRY'S PRIME ESSENTIAL

The "all-out" production of the war period has not only proven the importance of proper lubrication but has effectively demonstrated the superiority of LUBRIPLATE Lubricants. Even the most confirmed skeptic must admit that when two surfaces do not touch, there can be no appreciable wear. The separating film of LUBRIPLATE is tougher. That is why LUBRIPLATE Lubricants impart longer life to shafts, bearings, and gears. LUBRIPLATE has qualities not possessed by conventional lubricants.

LUBRIPLATE
Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRIPLATE arrests progressive wear.

LUBRIPLATE
Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

LUBRIPLATE
Lubricants are extremely economical for reason that they possess very long life and "stay-put" properties. A little LUBRIPLATE goes a long way.

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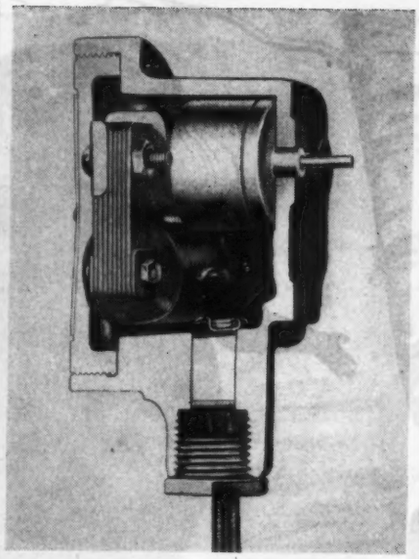

lacquer solvent vapors, and natural gas are found. Unit is totally enclosed in a bronze casting with removable screw cover, and is adapted for explosion-proof conduit mounting. Can be supplied in various shaft speeds, voltages, and frequencies. Carries Underwriters' approval label, Class 1, Grade C and D, for hazardous locations. Warren Telechron Co., Ashland, Mass.

Plywood Adhesive

"Amberlite PR-245," a plywood adhesive, is described by the manufacturer as a thermosetting phenol formaldehyde in dry powder form that is readily soluble in water, alcohol, and mixtures of the two. The resin is said to assure durable bonds, moderate flow during cure, fast cure at usual bonding temperatures, and to cure at temperatures as low as 160 deg. F. with all commonly used hardwood species. In bonding either plywood or laminated constructions, the resin is used with Catalyst Q-108 to accelerate rate of cure. Permissible limits in assembly time for various applications range from a minimum closed assembly period of 30 minutes to a maximum open interval of several days, allowing flexible spreading and pressing schedules in the plant. The Resinous Products & Chemical Co., Inc., 222 West Washington Sq., Philadelphia.

Grouting and Patching Compound

A compound, known as Ferrolith G, for use in concrete grouting and patching, repointing mortar joints, sealing, pre-cast pipe joints, and similar functions, has been announced. The material, it is claimed, when mixed with cement and applied as a grout, expands upon oxidation and overcomes the tendency of the concrete toward shrinkage. It is said to eliminate vibration and shifting of machinery, provide a secure anchorage for bolts placed in concrete, and strengthen structural and other supporting columns. The use of this compound, it is stated, permits the operation of machinery and use of bolts and other materials to which

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LUBRIPLATE represents one of the most important advancements in lubrication in many years. It possesses characteristics not found in conventional lubricants. In addition to superior lubricating qualities it prevents rust and corrosion. The adoption of LUBRIPLATE by practically all important industries and the Army and Navy is indeed a record of achievement. LUBRIPLATE is available in a number of fluid and non-fluid densities to meet every operating condition.

Rx FOR YOUR MACHINERY

No. 3—Ideal for general oil type lubrication. Ring oiled bearings, wick feeds, sight feeds and bottle oilers.

No. 8—Because of its high film strength and long life reflects outstanding performance in most types of enclosed gears (speed reducers).

No. 107—One of the most popular grease type products for general application by pressure gun or cups.

No. 70—For a wide range of grease applications, especially at temperatures above 200 degrees F.

No. 130-AA—Known nationwide as the superior lubricant for open gears, heavy duty bearings, wire rope, etc.

BALL BEARING—This is the LUBRIPLATE lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 5000 RPM and temperatures up to 300 degrees F.

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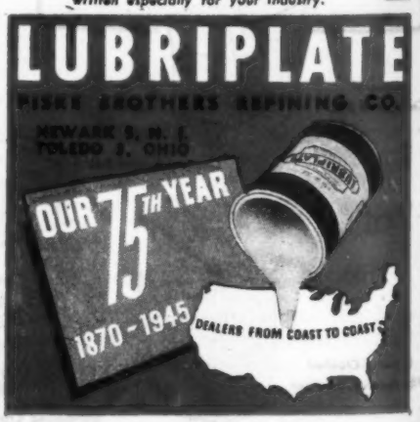
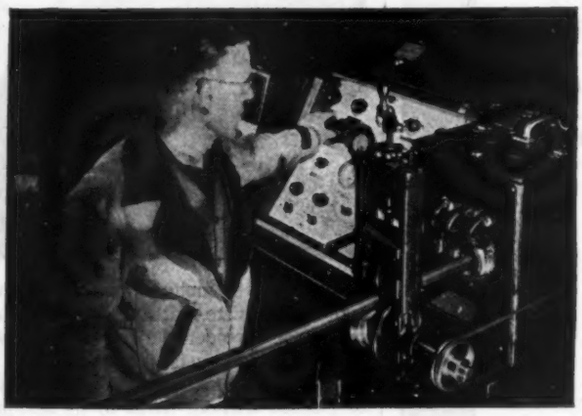


Answers...

with quality steel tubing

If you could check at a glance all of the wartime production and structural problems on, say, aircraft engine mounts—or in finding general production short cuts — or in adding superiority to fighting "front" equipment — you'd likely be surprised at the number of "answers" which have been found in steel tubing. Steel tubing offers "strength-weight" advantages in more ways than ever before—a fact revealed in the ever-widening variety of demands on OSTUCO's production.



The "magnetic inspector" — typical of the many machines and operations which constantly "keep an eye" on quality at OSTUCO.

OSTUCO recognizes the tremendous benefits quality steel tubing can offer its customers both structurally—and production-wise. That's why OSTUCO checks quality in every operation. For example, on this page is shown the magnetic inspector which separates analyses and shows up cracks, laps, small cuts and other defects. Dependable *delivery* of quality through the years has earned for OSTUCO an enviable record of low rejects—an enviable reputation for workability and adaptability on the production line.

Are you planning postwar superiority in your field? Why not check with the OSTUCO engineers to see how OSTUCO steel tubing can contribute to that superiority. Simply contact the sales office nearest you:

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HOUSTON, TEXAS.....1006 Washington
LOS ANGELES, CALIF.....Suite 200-170 So. Beverly Drive, Beverly Hills, California
MINNEAPOLIS 2, MINN.....402 Thorpe Bldg.
MOLINE, ILLINOIS.....225 Fifth Ave. Bldg.
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MANUFACTURERS OF SEAMLESS AND ELECTRIC-WELD STEEL TUBING

INVASION and war products *must* have right-of-way when and wherever needed... but Industry *must* be ready, when the signal changes, for a quick crossing or for open traffic... in order to carry on at full time and full speed... to furnish real jobs for those released from the services and from war plants. This requires planning—now!

If your planning involves fastening...consider Bostitching ...whether your materials are plastics... metals... cloth ...wood... paper... leather... or whether you are now using riveting... welding... gluing... nailing... tying. Bostitching may speed up your production...and cut your costs...as it has done in thousands of war and peace-time applications.

Investigate Bostitch... its complete line... engineering resources backed by 40 years' stapling experience... a nation-wide field force specializing exclusively on stapling. Send samples or a brief description of your fastening problem for suggestions.

Bostitch (Boston Wire Stitcher Company) 69 Blackmore St., East Greenwich, R. I. (or Bostitch-Canada, Ltd., Montreal).

Bostitch Staples in most sizes are now available.

Below: One of 800 Bostitch stapling devices. Bostitch automobile-aircraft stitcher... stitches aluminum, steel, plastics, together or to other materials . . . 300 stitches per minute.

BOSTITCH

fastens it better, AND FASTER with wire

ALL TYPES OF STAPLES APPLIED BY MACHINES
ALL TYPES OF MACHINES FOR APPLYING STAPLES

it is applied within 12 to 24 hours after grouting. Building Products Div., L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16.

Interlocked Hose

Asbestos packed interlocked galvanized steel hose with an inside diameter of 24 inches is claimed to be the largest hose of its kind in the world. It weighs approximately 70 pounds per foot and is manufactured for use on marine and stationary diesels as flexible exhaust pipes. Because of its interlocked construction it is said to require no special tools or heat to bend. Pennsylvania Flexible Metallic Tubing Co., 7203 Powers Lane, Philadelphia 42.

Apron

Heavy-duty apron, of a treated fabric combined with a plastic by a calendering process that is claimed to impregnate the fabric, is said to be acid proof throughout. The

apron is 35x47 inches, weighs 1¾ pounds, and is complete with sturdy ⅞-in. tape, criss-cross shoulder design, attached with reinforced grommets at top and side and with edges hemmed. Apron can be washed or cleaned without harm to its acid-proof qualities. The B. F. Goodrich Co., 500 South Main Street, Akron, Ohio.

Thermocouple Vacuum Gage and Control Unit

All-metal thermocouple vacuum gage features extreme ruggedness of construction and is assembled in a metal envelope. Connection to the vacuum system is made

...Out of the Blue!

• A design takes shape . . . the fabricated steel moves out on time . . . accurate workmanship and close adherence to "specs" the keynote . . . another satisfied customer! For accomplishing the unusual in the usual way is a matter of routine at Levinson.

LS-1

The LEVINSON STEEL CO.

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THE RIGHT COMBINATION FOR *Faster Handling*

Your requirements for faster handling of packaged materials can be met with the right combination . . . Rapid-Wheel Portable Gravity Conveyor and the Stevedore, Jr.

Each section of Rapid-Wheel Conveyor is a self-contained unit, adjustable from a minimum 6″ to a maximum 50″ operating height. . . . (Cam-Lock standards — same as used on Stevedore, Jr.) Sections are easily coupled together with self-locking coupler. Reversible curve sections and adjustable guard rails are standard accessories.

Rapid-Wheel Gravity Conveyor furnishes the power downgrade, while Stevedore, Jr. Power-Belt Conveyor saves man-hour-handling time in loading, unloading, stacking and elevating operations. Quick-acting "Cam-Lock" standards on the Stevedore, Jr. provide a range of adjustments to meet varied operating conditions — from 18″ level to delivery height of 72″. The Stevedore, Jr. plugs in standard 110 volt lighting circuit and lifts a 225-pound distributed load at the rate of 50′ per minute.

Write us about your handling problems and get facts on how you can save time and money.

OFFICES IN PRINCIPAL CITIES

THE RAPIDS-STANDARD COMPANY, INC.

370 Peoples National Bank Building — Grand Rapids 2, Michigan

through a standard ¼-in. IPS hexagonal shank pipe nipple. The control unit for the gage operates directly from 110-volt a.c. and indicates pressures in the range between 1 and 1000 microns. The gage output meter is calibrated directly in microns. The gage and associated control unit are utilized for locating leaks in vacuum systems. Vacuum Engineering Div. of National Research Corp., Boston 15.

Safety Visor

A face shield that is said to simplify visor replacement by a snap-fast design is announced. Perforations in the visor fit over small lugs and spring clamps at each end hold the visor in place. For release, a turn of the fingers snaps out the old visor and

a new one is slipped into position. The plastacele visor is said to be non-flammable and to protect the head and neck, fitting against the chest to prevent the entrance of flying particles from below. Chicago Eye Shield Co., 2300 Warren Blvd., Chicago 12.

Cement

Furane-base resin cement, called Duracite, is said to be resistant to inorganic as well as organic acids, alkalis, oils, and solvents, and to be of high compressive and tensile strength. Temperature range is 350 or 375 deg. F. Can be used as a mortar for acid-proof masonry in tank linings, floors, sewers, towers, and for other installations handling alternately acids and alkalis. The cement, which is in the form of a liquid and powder, and can be stored indefinitely before mixing without deterioration, is claimed to be resistant to abrasion, impact shock, and to rapid changes in temperature. Setting time can be controlled to suit the requirements of the individual job. U. S. Stoneware Co., Akron.

Liquid Concentration Control

Type P25N electronic concentrate control for detecting and controlling changes in liquid concentrations through operation of signals, valves, or pumps, is said to provide accurate control for all applications in which changes in concentration are accompanied by a corresponding change in electrical conductivity. Installation requires

THE RED HOT BEARING
That Froze to Death!

▶ THE SCENE: A 65 foot long, high speed press at Alco-Gravure Division of Publication Corporation, Chicago, Ill.—one of the nation's largest rotogravure printers.

▶ THE PLOT: The press has stopped. A moment before, an issue of a great national magazine was flying through the rollers. Now, there is the sound of anxious voices and the ominous smell of hot metal. Once more, a hidden bearing has run red hot . . . then frozen . . . *to death!* Precious time will be lost before it can be replaced . . . time that isn't allowed for in magazine printing schedules.

The press, including the folder, has more than 500 bearings that have to "take it," twenty-four hours a day, six days a week. This calls for super-lubrication. Yet, many of the bearings are inaccessible or difficult to reach with a grease gun. Many cannot be lubricated while the press is rolling. The result—more than 2 hours a day spent in lubrication, often by inexperienced oilers. Small wonder that bearings were overlooked.

▶ THE HAPPY ENDING: Management decided to end all possibility of human error by taking out "life insurance" for the press . . . *foolproof lubrication!* Alemite Lubrication Specialists recommended testing Centralized Lubrication on one unit of the press. Bearing failures stopped *at once!* The "go ahead" was given to equip the complete press and folder. Instead of 2 hours lubrication time per day, all 500 bearings will now require only 10 minutes per day *while the press is rolling,* for positive lubrication from a few central locations!

* * *

WITH ALEMITE Centralized Lubrication Systems, bearing failures due to faulty lubrication are eliminated — costly shutdowns avoided. Time for lubrication can be reduced more than 95% . . . costs of lubrication cut nearly 98%. . . . Because machines do not stop for lubrication, these systems add "M. P. T."* to any plant, enabling manufacturers to make and market a better product for less money. That's why most progressive companies with their eyes on post-war competition are installing Centralized Lubrication to obtain the competitive advantages of lower production costs. They want longer machine life and less depreciation.

**More Productive Time*

Illustrated above, is one of the four new Alemite Centralized Lubrication Systems at work. These systems are for manual or automatic operation on almost any type of machine.

Without obligation have an Alemite Lubrication Specialist call and demonstrate all four systems *right at your desk* with transparent working models. Examine them minutely . . . work them yourself. Actually see how machines get "M. P. T."* Drop us a line—Alemite, 1870 Diversey Parkway, Chicago 14, Illinois. In Canada: Belleville, Ontario.

ALEMITE

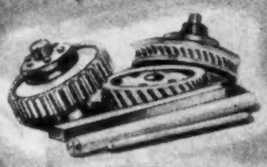
First in Modern Lubrication

Another Product of STEWART WARNER

CONSULTATION • EQUIPMENT • LUBRICANTS • ENGINEERING • MAINTENANCE

HOW TO MOVE

MEN



MATERIAL

MERCHANDISE

SAFELY– SURELY– ECONOMICALLY

AT FIRST GLANCE the solution to the problem of how to move men, material and merchandise up and down seems a simple one. Perhaps it is. Any elevator or dumb waiter will do.

But with postwar production, service, and sales closely tied to cost reduction — and with all signs pointing to an increase in the cost of materials and labor — *efficient* "man" handling and materials handling will undoubtedly be an important factor in the fight for lower costs.

And that poses still more problems. How to increase the efficiency of elevators and dumb waiters? How to simplify installation — service—repair—maintenance? The answer is, in a word—Sedgwick.

For more than 50 years Sedgwick elevators and dumb waiters have been moving men, material and merchandise safely, surely, economically.

Sedgwick Electric Freight Elevators, for example, have unlimited lifting capacity. They can be built to lift loads weighing well over 100,000 lbs. or loads weighing 2500 lbs. or less.

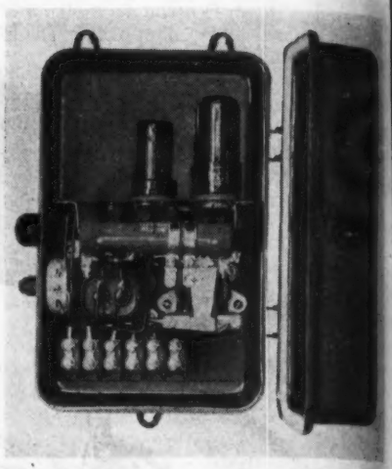
All Sedgwick elevators are equipped with unique safety devices which keep the car under complete control at all times. Added to this is simplicity of operation and control — ease of installation, repair and maintenance — smooth-traveling and sure-leveling.

We would like to tell you *more* about Sedgwick Elevators and Dumb Waiters. So if you are confronted by perplexing lifting problems — present or postwar—tell *us* about them. Our engineers will be happy to show you how Sedgwick Elevators and Dumb Waiters help reduce costs by making the movement of men, material and merchandise safer, surer, more economical.

Sedgwick MACHINE WORKS

138 WEST 15TH STREET, NEW YORK 11, N. Y.

ELEVATORS • HOISTS • SPECIAL LIFTS • DUMB WAITERS



only that a probe fitting be mounted on the tank, with probe extending into the liquid. Probe is wired to the electronic control, which may be located wherever desired. An adjustment on the control housing is set so that the control relay will operate when liquid of a predetermined electrical resistance touches the probe. Unit is said to have a sensitivity range of 100 to 5000 ohms. It operates on a 5 percent change in probe-circuit resistance regardless of variations in line voltage or tube characteristics. The voltage applied to the probe never exceeds 25 volts, thereby eliminating any possibility of electrical shock or explosion hazard. Photoswitch Inc., 77 Broadway, Cambridge 42, Mass.

Seepage Sealer

It is claimed that material called "Seep Seal," when mixed with cement, can be inserted in cracks or holes in concrete while water is gushing through, and will stop the leak in 2 minutes. Subways, mine shafts, reservoirs, foundations, and other underground concrete structures can be kept virtually leak-free with "Seep-Seal," according to the manufacturer. It can also be used for damp-proofing walls where mild seepage is encountered. Rock-Tred Corp., 629 West Washington Street, Chicago 6.

Welders' Cover Glasses

"Ipco" processed cover glasses are regular glasses (2x4¼ inches) that have been treated with a protective coating to guard against heat breakage and damage from metal spatter. They are covered on both sides with baked-on coating which, it is claimed, will not pit, peel, or rub off. Industrial Products Co., 2820 North 4th Street, Philadelphia 33.

Protective Coating for Spray Booths

"Triad PR" is announced as a protective coating for the sidewalls of both wet and dry spray booths. With this coating between the walls and the layer of overspray that normally builds up, quick and easy clean-up is said to be obtained. The booth

Positive SQUEEZ-GRIP *KILLS FIRE in seconds*

Here in four simple hand movements we come to grips with modern fire protection. Carbon dioxide gas, the fastest non-damaging fire extinguishing agent, is stored under high pressure in portable cylinders. The rapid release of the fire killing gas with the new SQUEEZ-GRIP valve saves time and gas. There is no wheel to turn. No need to set the cylinder down to operate it. C-O-TWO gas can be discharged or stopped as quickly as you can close or open your hand. In fact, it's so easy to use that even a woman or a child can operate it and extinguish a fire in seconds.

SQUEEZ-GRIP, originated and developed by C-O-TWO, is now used by all the Armed Forces. C-O-TWO manufactures a complete line of Portables, Hose Units and Smoke Detecting Systems.

KILLS FIRE—SAVES LIVES—*It's Safer—It's Faster—It's Modern*

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 NEW JERSEY

Only from Ampco can you get *all* of these services and benefits:

1. Distinctive properties of resistance to wear, impact, fatigue, corrosion.
2. A series of engineered alloys — with physical properties to fit your application.
3. Quality control to hold these properties within narrow limits.
4. Diversified production facilities — coordinating in one place all the commonly used metal-working processes.
5. Engineering and production "know-how" to give you a practical manufacturing program.
6. A nation-wide organization of field engineers to assist you.
7. A record of proved performance in hundreds of leading makes of equipment.
8. A national reputation that makes Ampco Metal parts a sales asset.

...one of 8 big reasons why you can depend on

AMPCO METAL PARTS

Quality control is one of the main features that set Ampco apart from ordinary sources of bronze—that assure you of an engineered alloy unvarying in its properties today, next month, or a year from now. This uniformity is important when performance of your equipment depends on material that *always* meets predetermined specifications.

• Ampco's laboratory control — a long-established feature of Ampco service — is carried out by the largest corps of technicians in the bronze alloy field.

Ampco also offers you the production "know-how" to *produce* to a standard.

• Utilize the exceptional properties of Ampco Metal in your post-war products —it pays! Send us your prints for helpful suggestions. Ask for bulletins. FM-2.

A-8B

Specialists in engineering, production, finishing of copper-base alloy parts.

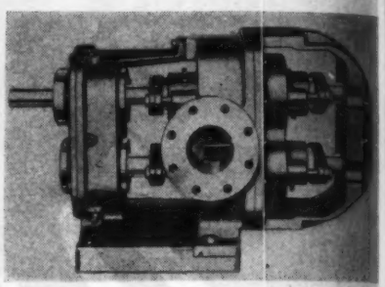
AMPCO Metal

Ampco Metal, Inc.
Milwaukee 4, Wis.
Ampco Field Offices in Principal Cities

is stripped clean by spraying with water or steam, the coating and accumulated paint flushing off together. In dry booths which have no drainage facilities, "Triad PR" facilitates scraping off the paint. Can be applied by either brush or spray gun, and dries to a hard, white, dustless coating which improves visibility in the booth. Detrex Corp., 13005 Hillview Avenue, Detroit 27.

Rotary Pump

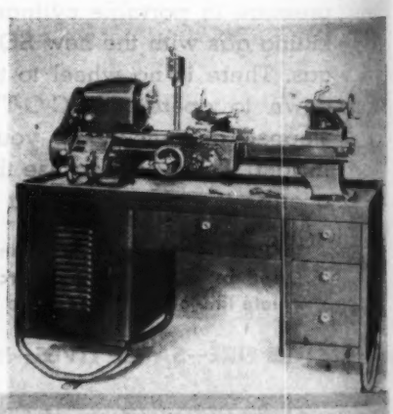
Industrial pump, designed for heavy-duty positive handling of liquids has operating speeds that range from 0 to 400 r.p.m. and capacity of 100 gallons per 100 revolutions. Made with ball bearings in both face plate and rear gear case, pump can



be furnished with either flanged or threaded intake and discharge ports. Because of its heavy construction, maintenance costs are said to be reduced to a minimum. Available in iron, bronze, nickel alloy, stainless steel, or other metals, and with direct, V-belt, or pulley drive. Bump Pump Co., La Crosse, Wis.

Cabinet Lathe

Combining all the features of the standard Logan quick-change gear lathe in a compact cabinet, the Logan No. 825 lathe is adaptable to toolroom work, for maintenance, for training, or for production. All moving parts and gears are completely enclosed. The power plant and underneath



drive are enclosed in the left compartment of the four-drawer, stipple-finished gray steel cabinet. A multiple V-belt drive transmits power from cone pulley to spindle. Three-point base assures a steady installation on any floor. Logan Engineering Co., 4901 West Lawrence Ave., Chicago 30.

New machines of all kinds will be improved

by the advanced Cast Bronze Bearings

developed for aircraft engines.

In precision, finish, and metallurgical uniformity

Bunting Cast Bronze Bearings, today, surpass

any bronze bearings ever before produced in volume.

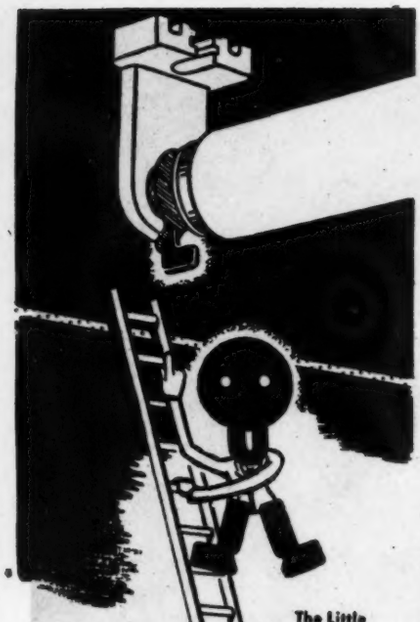
The Bunting Brass & Bronze Company, Toledo 9, Ohio.

Warehouses in principal cities. 10

BRONZE BEARINGS ★ BUSHINGS

★ PRECISION BRONZE BARS

Bunting



The Little Watchman

That's Me!

*FLUR-O-LOCKS, the "little watchman" are on duty night and day protecting employees and machinery from hazards due to insecure fluorescent lamp installation.

...Tends to increased efficiency of lamp, starter, and ballast.

By equipping your fluorescent lamps, you insure against faulty installations which may result in loss of current or falling lamps due to vibration . . . FLUR-O-LOCKS tend to increased efficiency of lamp starter, and ballast.

Falling lamps may cause serious injury to your employees or to your machinery and products. *Don't take this chance!* Order FLUR-O-LOCKS today from your General Electric, Westinghouse, Graybar Electric, Supply Houses or other distributors or write directly to the LADUBY CO for samples and descriptive folders.

Flur-o-locks by LADUBY COMPANY
176-180-182 BANK ST., NEW HAVEN 11, CONNECTICUT

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• NEW PROCESSES for applying copper plating to aluminum by dipping in special solutions, usually for the purpose of adding a coat of some other metal by electroplating, are announced by Technical Processes Division of Colonial Alloys Co., Philadelphia 29, and by the Enthone Co., 491 Elm St., New Haven 2.

• PAMPHLET describing use of Multilith forms for handling war contract termination procedures is available from Addressograph-Multigraph Corp., 1200 Babbitt Rd., Cleveland 17.

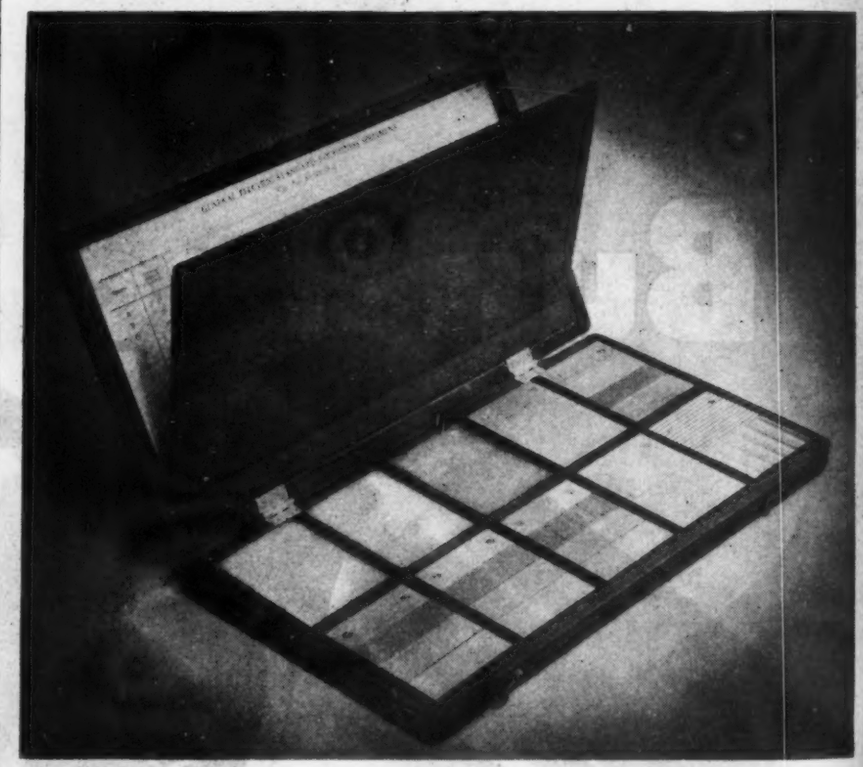
• PROTECTIVE TREATMENT for wood and textiles against rot, decay, mildew, and insects by application of Triple-A Copper Naphthenate Preservative is recommended by the manufacturer, Quigley Co., Inc., 527 Fifth Ave., New York 17.

• PROGRAM OF ACTION formulated by National Industrial Information Committee of NAM for explaining industry's general attitude toward post-war economic problems is described in a booklet, "A Time for Action." Copies may be obtained at the committee's offices, 14 West 49th St., New York 20.

• ABRASIVE CLOTH AND PAPER are made more resistant to wear caused by the effect of friction heat on the adhesives, by impregnation of the bonding materials with particles of inert, non-fusible minerals such as calcium carbonate. The process has been developed by the Behr-Manning Corp., 1933 Sidford St., Troy, N. Y.

• PORTABLE FIRE ESCAPE STEPS, fastened by chains, may have possibilities in industry beyond their name-described purpose. Suggested uses include the servicing of overhead equipment, access to roofs, and for work done in pits. Product is made by Metal-Portable-Fire Escape Co., Murray Bldg., Grand Rapids 2, Mich.

• FOR HAND-STAMPING numbers or letters in aluminum or magnesium alloy parts, sets of round-faced dies are offered by New Method Steel Stamps, Inc., 147 Jos. Campau, Detroit 7. Round-faced in-



STANDARDS FOR MEASUREMENT OF SURFACE ROUGHNESS of materials are provided, arranged in a specimen kit, by General Electric Co., Schenectady. Set consists of ten metal specimens, each 2x2½x⅛ inches. They were designed to enable engineers or draftsmen to select and specify by symbol the degree of surface roughness desired or permitted on machine parts or other materials. Specimens simulate 25 surface types

SOLNUS OILS...Lowered Temperature of 1200-Pound Roll Bearings, Eliminated Semi-Yearly Oil Change in Paper Mill

A prominent manufacturer of fine papers ran into trouble in lubricating two super calenders. Bearings on the 14 rolls were 15" in diameter, revolving in bronze bushings. A well-known make of oil was being used in the circulating system, but the bearings were running hot. The oil sludged and had to be changed twice a year. Finally, when one bearing caught fire, the management called a Sun Oil engineer for his recommendation.

Forty gallons of oil were drained from the system and replaced with the proper grade of Solnus Oil. The machines were put back in operation, and bearings stayed at a normal operating temperature.

After two years, the management reported the Solnus Oil did not sludge.

Continuous operation of this sort is only one of the results of good lubrication. Paper mills in many parts of the country are utilizing the experience of Sun engineers and the quality of Sun lubricants to maintain peak operating levels, to cut down maintenance costs, and to eliminate chronic trouble spots. Sun makes a complete line of quality oils and greases for every type of paper machinery, and for all other industrial equipment. Call in a Sun engineer for a scientific study of your oil needs.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***
Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

SUNOCO

SUN INDUSTRIAL PRODUCTS
OILS FOR AMERICAN INDUSTRY

PROPELLER HUB GRINDING DUST EFFECTIVELY COLLECTED with AAF ROTO-CLONE DYNAMIC DUST PRECIPITATOR

Close-up of Type D Roto-Clone with Aftercleaner. Diagram shows how propeller hub fits into specially formed end of dust collection pipe, which comes up into the base of the grinding table.

ROTO-CLONES WITH AFTERCLEANERS RETURN CLEANED AND FILTERED AIR TO WORKROOM

None of the dust from the final grinding operations on the inside of these propeller hubs escapes collection — it is all drawn down through the Roto-Clone collector pipes over the openings of which the hubs fit snugly.

A feature of this installation is that the air used to collect the dust is returned *clean* to the workroom, through viscous filter after cleaners mounted directly on the Roto-Clones. The atmosphere of the workroom *stays clean* and room temperatures and workers' visibility, comfort and efficiency are unaffected by any process dust. Only extremely compact, efficient Roto-Clones make possible dust collector arrangements like this one. Roto-Clone is a combined dust collector and precipitator requiring minimum floor space. Installation is simple and operating costs are extremely low. Roto-Clones are available in a wide range of sizes for the collection of all types of process dust. Send for Bulletin 272.

AMERICAN AIR FILTER CO., INC.
Incorporated
361 Central Avenue, Louisville 8, Kentucky
In Canada: Darling Brothers, Ltd., Montreal

dentations produced are said to be less likely to cause cracks in the metals than marks made with sharp-edged punches.

• ELECTRIC ARC TORCH that provides a flame of 9000 deg. F. for use with any a.c. or d.c. welder for welding, brazing, pre-heating, soldering, or hard-surfacing, is new product offered by Mid-States Equipment Co., 2429 South Michigan Ave., Chicago 16.

• BLACKENING PROCESS for chemically coating ferrous parts, known as "Ferro-toning," which can be applied at relatively low temperatures and without two oxidizing solutions, is available from Turco Products, Inc., 6135 South Central Ave., Los Angeles 1.

• ELECTRIC POWER provides the pressure in a new-type "gun" for applying various viscous materials such as paint, lacquer, mastic calking, cement coating and fibrous insulation. Pressure is said to be sufficient to be operated through several hundred feet of hose, and the hose may have several heads to serve an equal number of operators. Stewart-Warner Co., Industrial Alemite Div., 1826 Diversey Parkway, Chicago.

• SHAPING MACHINE that cuts all teeth in a gear simultaneously is being produced by Michigan Tool Co., 7200 East McNichols Rd., Detroit. A 51-tooth, 4-in.-dia. gear with 1-in. face can be cut in less than one minute.

• HEALTH AND SAFETY MEASURES by foremen and employees in the plant of the B. F. Goodrich Co., Akron, are encouraged in an easy-to-read story of "The Return of Tattle Tail Rat," printed by Goodrich as a 12-page leaflet and distributed through its factory. Similar technique should be effective anywhere.

• LABELS PRINTED ON CELLULOSE TAPE are covered with a second layer of the same transparent material by a machine that does both the printing and laminating processes. Advantages claimed include increased protection against wear and against oil, gasoline, and salt water. Topflight Tool Co., P.O. Box 6728, Towson, Md.

• PRINTING DIRECTLY on metal or other materials can be done with a self-inking "wheel-type" marker produced by Adolph Gottscho, Inc., 190 Duane St., New York 13. Printing is done by manually rolling the press across the face of the material. Special models are adaptable to two or more colors.

• REMOVAL OF RUST may be accomplished by use of a solvent, "Carbozite," announced by Carbozite Corp., First National Bank Bldg., Pittsburgh 22. It is claimed this product has an affinity for rust, but will not attack unoxidized material. Brush, spray, or dip methods may be used to apply the solvent.

• SOLUTIONS OF 100 PROBLEMS in arc-welding design of products and equipment installations are provided for

Glass gives you more than transparency . . . *far more!*

It is the *combination* of favorable characteristics that makes glass the ideal material for many of its common uses!

Take windows, for example. Glass is used for its transparency, to be sure. But also because it stands up under the most difficult weather—year after year—without any harm to the smoothness and hardness of its surface. Because it keeps its original luster and beauty without any refinishing. Because it *stays* easy to clean.

When you think of the materials to use for your postwar products, or for the improvement of your plant equipment or processes, bear in mind the combination of characteristics that gives glass the stamina—the durability—to do jobs that no other material can do so well.

And remember that glass is versatile—available in many finishes, colors, shapes and weights. We'd welcome the opportunity to discuss how the performance characteristics of glass can help you. Libbey·Owens·Ford Glass Company, 5725 Nicholas Building, Toledo 3, Ohio.

Here's the combination that makes GLASS one of the world's most versatile materials:

CHEMICALLY, the most stable of all materials, except the noble metals. Won't rot, oxidize or disintegrate, plus—

DIMENSIONALLY STABLE. Coefficient of expansion extremely low. Keeps its shape, plus—

SURFACE, among the world's hardest and smoothest. Non-porous, won't absorb odors or moisture. More acid-resisting than any structural material. Unusual resistance to abrasion. Weathering qualities unequaled, plus—

STRONG, tempered glass is stronger than some metals. A square foot, ¼" thick withstands pressure of 60 lbs. per sq. in. and thermal shock of 400° F. Will not burn, plus—

ELECTRICAL INSULATOR of outstanding strength.

L O F **LIBBEY·OWENS·FORD**
a Great Name in **GLASS**

Destructible? **Wood — Metal — Plastics — Glass. No material is indestructible. However, barring unforeseen conditions, no material will fail on a job in which it has been properly specified and engineered. When our application engineers say "Yes", you can be sure about glass.**

THE ANSWER IS WORK!

Largely because war materials are being consumed at an incredible rate, our Generals and Admirals are calling for MORE. And so we've all got to get back on our "win the war" job. We *must* support our fighting fronts.

How can we do it? Is there really a manpower shortage as many seem to think? Frankly, I doubt it. In my opinion, the job will be done if every one of us will do a little more work and a little better work.

A lot has been said, these days, about the failure of labor to produce what it should. But the fact remains as I have said many times, "Labor is only as efficient as management plans for it and gives it the tools with which to work."

We are all being challenged by the Generals and Admirals on our fighting fronts.

You, Mr. Industrialist and Mr. Businessman, can help meet this challenge by tightening up your controls, your planning and your scheduling.

You, Mr. Labor Union Management, can help by adhering to your no strike rules, by reducing absenteeism and persuading your members to produce at 100% capacity.

There *is* an answer to the manpower situation. There *is* an answer to the call for more war materials.

The answer is WORK!

Geo. A. Trundle Jr.
President

THE TRUNDLE ENGINEERING COMPANY

Brings to Industry and Business

26 Years **OF MANAGEMENT ENGINEERING EXPERIENCE**

GENERAL OFFICES • CLEVELAND • BULKLEY BUILDING

CHICAGO
City National Bank Bldg., 208 S. La Salle St.

NEW YORK
Graybar Bldg., 420 Lexington Ave.

the use of engineers and designers in a booklet, "Practical Design for Arc Welding, Vol. 2," published ($3.50) by Hobart Brothers Co., Troy, Ohio. Detailed diagrams for each solution are intended also to serve as idea stimulators.

• INCOME TAX and excess profits tax procedures for 1944 are explained in a booklet published by The Research Institute of America, 292 Madison Ave., New York 17. Single copies may be obtained on application, without charge.

MASKING STICKERS, die-cut, protect name and instruction plates from painting operations, are supplied by Avery Adhesives, 451 East Third St., Los Angeles 13

• NEW TRAINING COURSE in resistance welding control, consisting of slide-sound films, lesson and quiz books, and instruction manual. Arranged for seven lessons. May be purchased from Westinghouse Electric & Manufacturing Co., Extension Training Department, 306 Fourth Ave., Pittsburgh.

• "SEE OVER YOUR LOAD" appears on one side of a 10x30-in. poster, "Yank Them Out" on the other. "Beware of Sharp Edges" and "Keep Oil Off Floors" are shown on another sheet. These job safety posters are offered by the U. S. Department of Labor, Division of Labor Standards, Washington 25, D. C., to promote consciousness of lurking danger in the minds of workers.

• PROCEDURES in commercial and voluntary labor arbitration are explained in booklets of the American Arbitration Association, 9 Rockefeller Plaza, New York 20.

• WITHHOLDING TAX may be computed quickly in preparing payrolls by use of a device called "Deductax," produced by Remington Rand, Inc., Buffalo 5.

• NEW FILMS: *Problems of Supervision* is the title of a new series of 16 sound motion pictures, in 16-mm. size, produced by the Federal Security Agency of the U. S. Office of Education. They are on sale at Castle Films, 30 Rockefeller Plaza, New York 20.

...plus Remote Control in a HOBART

The right electrode for a specific application, when applied with PROPER CONTROL OF HEAT, will produce the desired properties in the weld. Guess work doesn't count, for example, in the welding of Stainless Steel as illustrated above, spoilage cannot be tolerated because it is one of the more costly metals and rejects mean a considerable loss in both time and material.

The right type of electrodes is plentiful, but are you sure you're getting the PROPER HEAT CONTROL with your present welding equipment? Hobart offers the latest development in CLOSE ARC CONTROL. It's possible to obtain 1,000 different combinations of voltage and amperage with the Hobart "Simplified" Arc Welder, and without a single dead spot. In addition to this Multi-Range Dual Control, you get Hobart's exclusive Remote Control. Both will save you money! Investigate the advantages of Hobart "Simplified" Arc Welding today! Coupon for your convenience.

HOBART BROTHERS COMPANY
Box FM-25 Troy, Ohio
"One of the World's Largest Builders of Arc Welders"

A Better Rod for Every Purpose
Hobart laboratories make rods for each specific job. It is tested—improved — perfected — order Hobart Electrodes and you'll understand why they're the choice of those who want quality. Write for your price list.

Over 100 Designs in work book form. Invaluable for drafting room or shop. Get your copy today!

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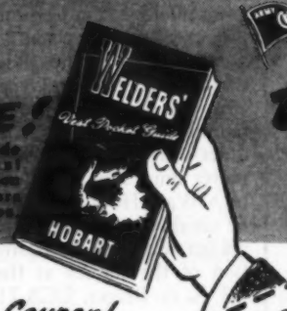

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Significant Labor Developments

BENJAMIN WERNE, Lecturer in Government Regulations, New York University. Member of the New York Bar

Period Surveyed: December 10 to January 10

TREND INDICATORS

Authority of Wage-Hour Administrator

THE WAGE-HOUR ADMINISTRATOR has been empowered not only to direct reinstatement of an employee discharged for filing a suit under the Act but can also obtain back pay for the employee for time lost. The fact that the employee has the right to sue for back wages does not prevent the Administrator from enforcing such payment, since such action is more in keeping with the objective of labor legislation. (Walling vs. O'Grady, CCA-2)

Damages Held Not a Penalty

Liquidated damages for not paying minimum wages under the Wage-Hour Law were held to be compensation and not a penalty. Therefore, a suit for liquidated damages in California would be covered by a 3-year statute of limitations. In deciding that the law is not punitive, the court's test consisted of determining whether or not the wrong to be redressed was a wrong to the public or a wrong to an individual. (Culver vs. Bell & Loffland, Inc., CCA-9)

Enforcing Penalties Under Wage-Hour Law

Although an employer guilty of violating the Wage-Hour Law was not punishable by imprisonment, the court held that he might be placed on probation for restitution of the wages due under the Act. The government, claiming probation to be improper where the penalty was a fine only, sought to have the judgment set aside when difficulty about signing the checks arose in disbursing the money. In sustaining the propriety of the probation order, the court declared that the employer must sign the checks as determined by a Wage-Hour Division officer, and that he would be punished for contempt if he deliberately tried to obstruct the distribution of the money as the court ordered. (U. S. vs. Berger, CCA-2)

Releases

The WMC granted releases for "undue personal hardship" to an employee who was transferred to a job which did not provide the customary overtime and to another who did not obtain the upgrading for which he was qualified. In the first case, the employee had been transferred on his own request but with the assurance that the overtime would be available to him. The promise not having been fulfilled, he was granted a certificate of availability. In the other, the employee having been employed in a company in which the higher classification did not exist, was permitted by WMC to leave his job. (WMC Regional Appeals Committee at N. Y.)

Enforcing WMC Orders

New Priorities Regulation 26, issued by WPB, enables WMC to enforce its duties by penalizing the violator through withholding materials priorities. To invoke this sanction however, WMC must certify that the employer involved has refused to comply with either an employment ceiling or a hiring regulation within a reasonable time after having been informed of the violation, and the employer should be given a chance to state his case before a WPB compliance commissioner.

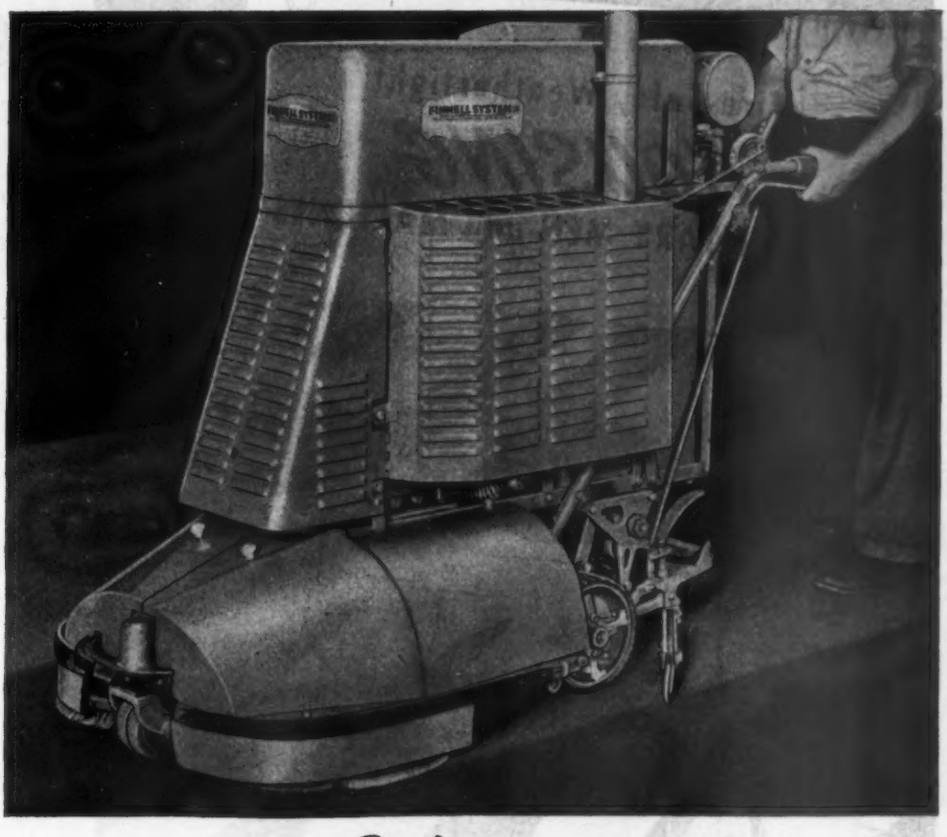
Computing Time

Whether or not employers not subject to the Premium Pay Order may compensate their employees for time not worked on holidays depends on the industry-area practice. The "industry" consists of the grouping of businesses used by the board for fixing wage brackets, or a group of companies which are the company's direct competitors; the "area" comprises the labor market area of which the company is a part, or the immediate community in which the company is located. It is not necessary that a practice be universal for it to be deemed a practice of the area. Care must be taken, however, in selecting the companies to be included in the group that reflect the area practice. A unionized company, for example, would be bound by the practice of other unionized companies, despite a contrary practice that is prevalent in the total group of unionized and non-unionized companies.

Held Time Worked

Time spent in checking company tools in and out of company cribs. The employer claimed that such work was not to be compensated where the lunch period was paid for; however, since this was never reduced to writing, the arrangement could not be held binding upon the parties. (Ford Motor Company, Arbitrator)

Time spent by bakery-salesmen in lading in the morning and checking in at



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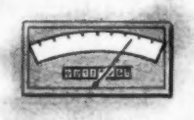

When the *215-G Self-Powered Finnell* has traveled over the floorways for an hour, it will have scrubbed and dried approximately 15,000 sq. ft. of floor! That's about 6,000 sq. ft. more coverage than even the next fastest Combination Scrubber (designed for use in plants less vast) can give in the same period . . . not to mention machines and methods far too inadequate for large-scale scrubbing. Thus, in a couple of hours, the *215-G Finnell* would be miles ahead of any other type of equipment on vast-area scrubbing.

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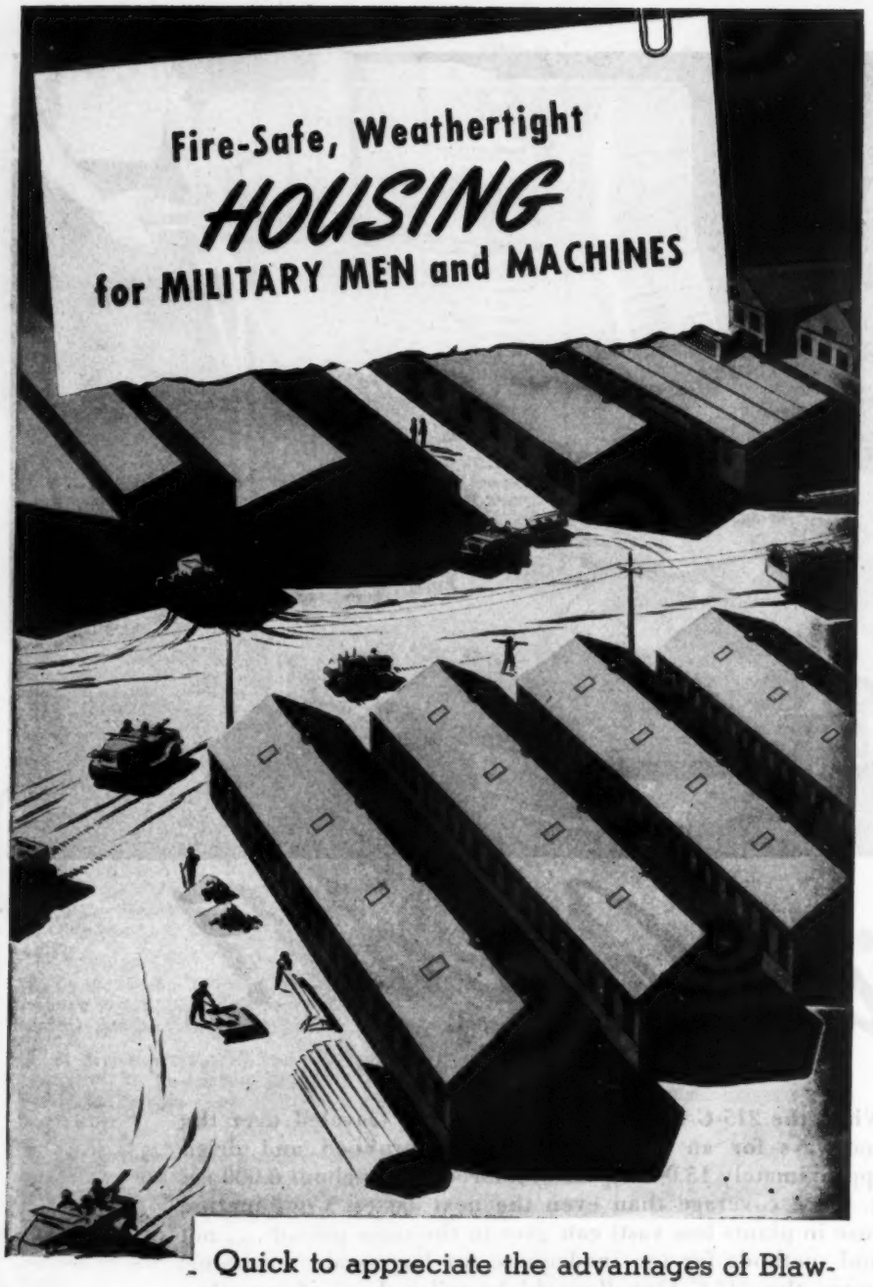

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night. (Denver, Colo. Bakery Industry, RWLB-IX)

Held Under the Act

Pieceworkers are now subject to the provision of the Wage-Hour law in the same manner and to the same extent as hourly rated employees. The court held that neither the intent of the Act nor its legislative history indicates that pieceworkers be deprived of the benefits of the Act. Because the Act uses the terms minimum rate "an hour" and a "regular rate" of pay, it does not mean that workers compensated on a different basis are to be excluded. (U. S. vs. Rosenwasser, U. S. Sup. Ct.)

Where an Administrator has issued a subpoena under the Wage-Hour law, and has reasonably shown that the employer is covered by the Act and that the records subpoenaed were necessary to the relevant inquiry, the employer was required to produce such records and books. Since the Act provided that the Administrator may conduct investigations of industries subject to the Act and may find a general industry amenable to the law, there is no reason for the newspaper industry to be exempt from such subpoena. (Walling vs. Daily Press, Inc., USDC E. Va.)

Employees of a short line railroad not operating as a common carrier. These employees, however, do not come under the overtime exemption because of a prior ICC decision that the railroad, though recognizably engaged in interstate commerce, was not a common carrier but rather a plant facility for the companies it serviced. (Walling vs. Rockton & Rion Railroad, CCA-4)

Held Not Under the Act

Assistant safety engineer and captain of the fire department of an ordnance plant were held under the administrative and executive exemptions of the Act. The holding was based on the fact that the chief safety engineer, in effectuating the safety policies of the company, performed non-manual work requiring him to utilize his own discretion. The captain, although supervised, performed work materially different from that of firemen beneath him and had a say in the hiring and firing of firemen. (Distelhorst vs. Day & Zimmerman, Inc., USDC S. Ia.)

Employees engaged on a lake vessel even when they are engaged in fitting out and laying up such vessels during the non-navigable season. The court held the repair work done by the workers to be part of their duty as seamen. (Weaver vs. Pittsburgh Steamship Company, USDC N. Ohio)

Held Under Walsh-Healey Act

Owner-operator of a truck, drivers of the company trucks, and drivers working for a subsidiary corporation. Those drivers, however, who were employed and paid by independent trucking operators were held exempt from the Act. (Douglas County Gravel Company, Public Contracts Administrator)

(Continued on page 218)

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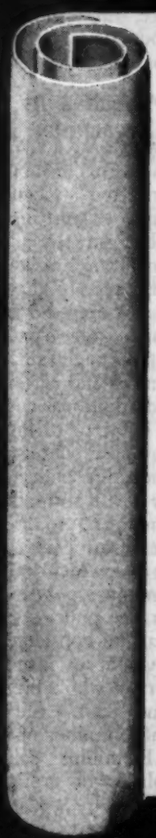

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Here at Weatherhead we build the parts that go to make up such products. And ever since 1919 the growing number of Weatherhead research, design and production engineers have been creating parts of greater demonstrated uniformity—dependability—efficiency—parts that have become a "must" in many a plant . . . lowered the cost of many a product! They are parts that *work better* and *still cost less.*

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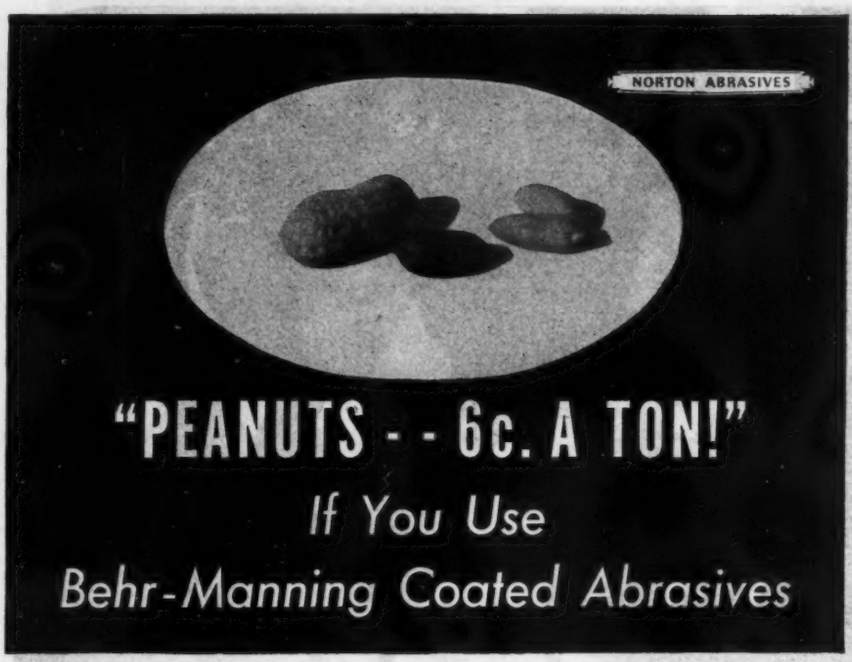

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(DIVISION OF NORTON COMPANY)
RELIABLE COATED ABRASIVES SINCE 1872

(Continued from page 216)

WAR LABOR BOARD

* *Basis for Approval of Rate Ranges*

RWLB, holding rate ranges were unstabilizing, set forth the following tests as justifying approval of the establishment of rate ranges: (1) Establishment of rate range before the passage of the Wage Stabilization Act; (2) customary usage of the ranges rather than single rates in the industry involved; and (3) prevalence of ranges in the particular classifications involved, despite the fact that single rates may be characteristic of the industry as a whole. (RWLB-X)

* *Merit Review Plan*

In ordering a merit review plan for an aircraft company similar to the New York system (which includes the Rane formula), the probability of the adoption of the New York system by the national board becomes greater. If the national board does adopt this system, it means the widespread use of similar plans throughout the country. (Consolidated Vultee Aircraft Corporation, WLB)

* *Automatic Progression Permitted*

In the interest of war production, WLB confirmed a regional board's approval of automatic ingrade wage increases in a dispute case. The national board's policy on automatic wage progression plans had not been formulated when the regional board approved the increases. The plan was not substantially different from those now approved in voluntary cases, and its acceptance was prompted by the needs of war production. (Zimmerman Steel Castings Company, WLB)

* *Amendments to Wage and Salary Regulations*

The term "insurance and pension benefits permitted" means amounts paid by an employer on insurance premiums on a policy on the life of an employee, the beneficiaries of which are designated by the employee, to the extent that the benefits do not exceed 5 percent of the employee's annual wages or salary, determined without the inclusion of insurance and pension benefits and without the inclusion of bonus and additional compensation.

The type of insurance on the life of the employee contemplated is the ordinary or whole life policy, which does not provide for a cash surrender or loan value, or both, amounting to a large percentage of the premiums paid. For example, premiums on endowment policies, single premium life insurance policies, fixed payment life insurance policies, and other similar policies shall be considered wages or salary. The payment of insurance premiums on ordinary or whole life policies referred to above must be for the benefit of more than a small number of selected employees.

Premiums paid by an employer on policies of group life insurance without

* In this and the following classification items marked with an asterisk also are considered to be trend indicators.

A Kidde portable extinguisher quickly smothers fire in a motor-generator set, without danger of shock or damage to insulation.

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Safe, clean, fast — Kidde extinguishing equipment is ready to take on the job of guarding *every* tough-fire area in your plant. Check the accompanying list of hazardous locations — then ask a Kidde representative to show you how best to protect them.

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cash surrender value, covering the lives of his employees, or on policies of group health, hospitalization, or accident insurance, covering his employees, the beneficiaries of which are designated by such employees, do not constitute wages or salary (regardless of the amount of wages or salary otherwise received annually by such employees).

Penalties for violation of stabilization rules may be mitigated in the discretion of WLB, the Commissioner of Internal Revenue and WFA. Less than the full statutory penalties for violation of the Stabilization Act may be imposed where extenuating circumstances warrant such modification. These three bodies may also designate the government agencies which shall disregard the amount of the penalty.

* *Increases Through Subterfuge Penalized*

A firm that utilized a subcontractor to obtain chip washers and paid them at rates in excess of what it would have been allowed to pay, was held in violation of wage stabilization regulations. Although hired by the subcontractor, the chip washers were considered employees of the company, inasmuch as their work was serviced and supervised by the company, and their finished products went directly to the company. Since the board found that the company was not wholly at fault, it recommended that the Treasury disallow for income tax purposes only a portion of the illegally paid wages. (Timken Roller Bearing Company, RWLB-V)

* *Increase to Blanket Certification List*

Adopting a "blanket certification list" under which above-bracket wage relief is accorded applicants in both voluntary and dispute cases, the WLB gives critical foundries and forge shops the right to make increases averaging up to 10 cents an hour above going wage bracket minima. The "blanket certification list" will be compiled jointly by the WLB and WMC and submitted to WLB in Washington. This new procedure will primarily benefit common labor and semi-skilled classifications, where the manpower situation is most critical, and will not affect higher-skilled rates except in rare cases.

* *Pay Guarantee Granted*

A weekly guarantee to a driver salesman for soft drink company was increased from $29 to $40 a week where an intra-industry inequity was found to exist. The new guarantee was sufficiently low so as to allow a margin for fluctuations in earnings resulting from the employee's own initiative. (Coca-Cola Bottling Company, WLB)

Partially Retroactive Pay Granted

Where both parties to a wage dispute were responsible for an excessive delay in settlement, the retroactive date for a wage award by a RWLB was set midway between the time the union first set forth its demands to the company and the time when the

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Here's why! K&M Ebonized Asbestos is made especially for modern electrical insulation requirements. It consists of a perfectly proportioned combination of asbestos fibre, binding cement, insulating compound, molded under intense pressure into strong monolithic sheets.

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Exceptionally high dielectric strength.
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Expanded production facilities make K&M Ebonized Asbestos available for *immediate delivery*. Comes in thicknesses from 1/8" to 4", standard or special "panel" finish. Specially developed to meet technical requirements of the Underwriters Laboratories, Inc., when built into an assembled unit. For further information, write us.

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In either fresh or salt water atmospheres, metal surfaces covered with one quickly applied coat of Tectyl are protected for as long as two years. The Tectyl film is transparent, so you can inspect the metal at any time. It's easy to put on by spraying, dipping, brushing, or flushing, and easy to take off with kerosene.

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dispute was certified to the board. (Easton Industrial Corporation, WLB)

Increase Denied

WLB denied a wage increase to drivers of a privately owned bus company to bring the latter's rates up to the rates paid to operators of a city-owned streetcar system. Since city streetcar operators were not subject to wage stabilization rules the comparison was not a relevant one. The drivers' rate, with a 5-cent hourly safety bonus (earned by 85 percent of the drivers), was deemed to be in keeping with the stabilized rate for the job. (Great Lakes Greyhound Lines, RWLB-XI)

An increase to eliminate intraplant inequity resulting from a prior wage increase to women workers to remove a sex differential was denied by WLB, on the grounds that such an increase would be violative of wage stabilization principles. The prior wage increase had resulted in common labor receiving the same rate as higher-skilled women workers in the plant. (Ewauna Box Company, WLB)

* *Incentive System Denied*

A request for the establishment of the same incentive system in one plant department as existed in another was denied by WLB in accordance with its policy of not ordering incentive systems in dispute cases. The regional board, however, was directed to seek ways to eliminate the alleged inequities. (Tennessee Coal, Iron & Railroad Company, WLB)

Request for Guaranteed Work Week Denied

While a regional board ordered a transit company to pay time and one-half to operating employees for hours in excess of 44 a week, and to garage workers for hours in excess of 40 a week, it denied the union's request for a guaranteed work week of 57 hours to operating employees and of 54 hours for shop employees. Inasmuch as the employer had to pay the overtime, the board concluded, he should have the right to arrange his work schedule so as to minimize the overtime hours. (Trenton Transit Company, RWLB-III)

* *Health Insurance Benefit Ordered*

Following a plan in existence in part of the furniture industry in the area, RWLB ordered a furniture company to establish a health insurance plan for its employees, under which the company was to pay 60 percent of the premium while the employees pay 40 percent. (Super-Built Furniture Manufacturing Company, RWLB-X)

* *Night Shift Differentials Ordered*

Basing its decision on area practice in the metal trades industry, rather than intraplant uniformity, RWLB ordered night work differentials of 5 and 10 cents for die-makers who work on the second and third shifts. (Aluminum Company of America, RWLB-X)

Pay Premiums Denied

Disallowing a 5-cent premium to be paid to certain groups of employees because

No landing deck for them!

"Eyes of the fleet" are the pilots of cruiser-based scouting planes. Catapulted into the air they seek out enemy ships; radio their location and the effect of our gunfire.

But that's just part of their job. On a flight that covers thousands of square miles of ocean they may bomb or strafe light vessels and submarines, machine gun Jap airplanes, lay smoke screens.

On return, scouting planes must land near the motherships to be picked up by crane. There is no landing deck on a cruiser. They must hit the water after every flight!

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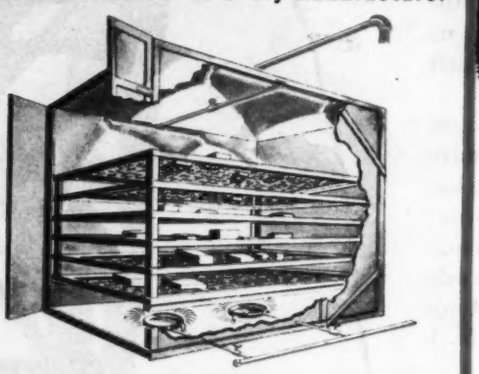

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The Time: Summer, 1944.

The Place: "Automatic's" Test Yard, at Youngstown, Ohio.

The Occasion: A test to determine the fire protection value provided by FIRE-FOG for a Dryer.

Frankly, FIRE-FOG was "on the spot"—other fire protection methods had failed.

Conditions at the manufacturer's plant were simulated. A test oven was built; drying racks were made; pieces of material distributed over the racks. Gas burners were lighted and the temperature brought up to the ignition point for the material tested and maintained for 15 minutes—*then* FIRE-FOG was introduced into the oven through FIRE-FOG Nozzles.

The result?—in only a matter of seconds the fire was extinguished! And only a few gallons of water had been used!

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they had been with the company for five years, WLB points out that the content of the job is the governing factor in wage differentials, and not merely length of service. The union claimed that additional duties fell to these employees since many trained employees had left for more attractive employment. The issue was returned to the regional board to determine the content of the job with the additional duties. (Empire Storage & Ice Company, WLB)

** Compensating Piecework*

In order to equate piecework earnings in the same plant, a company was ordered to revise and retime its piecework operations so that employees performing work requiring the same skill and efficiency would receive the same hourly earnings, regardless of the size of the machine they operate. (National Carbon Company, Inc., WLB)

** Sick Leave Plan Determined by Area Practice*

The fact that WLB will not order sick leave plans in dispute cases does not bar it from modifying such plans according to industry and area practice. In one case, where the board found more generous sick leave plans in the area and industry, it ordered an oil company to change its existing plan from 15 days sick leave yearly to allow accumulation of sick leave up to 30 days. (American Oil Company, RWLB-I)

** Union Shop Provision Ordered*

WLB ordered an employer to incorporate the union shop provisions, which had been previously obtained by a prior contracting union, into his contract with the new union, which had defeated the previous one in a recent election. Because the new union had violated the no-raid pledge, the board held that only those workers hired after the date of the election need join the union. (Ball Brothers Company, WLB)

** Union Activity Limited*

While WLB ordered an employer to permit his employees to engage in union activity on company property outside of work periods, the board limits this activity by forbidding more than 8 workers to participate at any one time. (American Telephone & Telegraph Company, WLB)

** Reinstatement With Back Pay*

Where strikers were discharged on their return to work, WLB ordered their reinstatement with back pay as of the date they offered to go back to work. The strike had been partly provoked by the employer and was in no wise a violation of a contract. The board granted, however, that the employer might take disciplinary measures which were to be subject to appeal through grievance machinery in the contract, including arbitration if necessary. (Stanolind Oil & Gas Co., WLB)

Employer's Right to Exemption Under the Wage-Hour Law

The employees of a food processor, claiming intraplant inequity between the proc-

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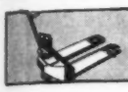
HYDRAULIC HIGH-LIFT TRUCKS — ASK FOR BULLETIN 136



HYDRAULIC PALLET LIFT TRUCKS — ASK FOR BULLETIN 132

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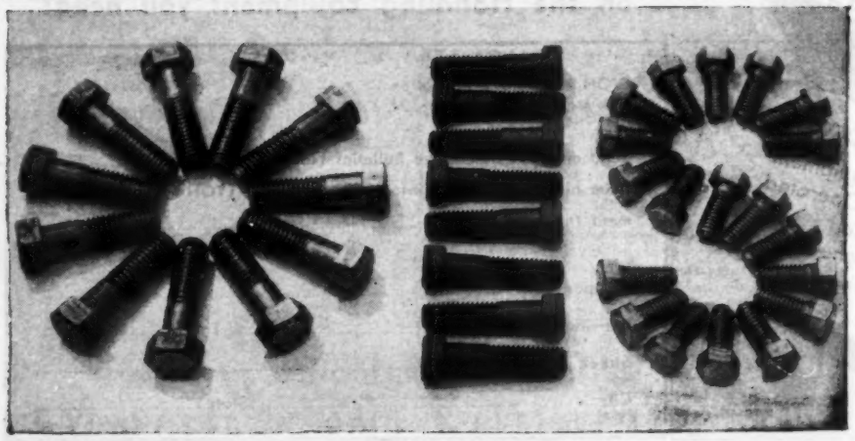

essing employees who did not receive overtime during the 14-week yearly processing season and the remaining employees, were denied the right to overtime. The board ruled that it would not compel one employer to pay overtime he was not required to pay because exempted under Wage-Hour Law when all his competitors were taking advantage of this exemption. (Kuner-Empson Company, RWLB-IX)

NATIONAL LABOR RELATIONS BOARD

* *Question of Representation Raised*

Board will not protect from a rival union a certified union which had not obtained a contract after 32 months, and now referred the controversy to the WLB. The board pointed out that the delay was not caused by referral to WLB, but rather by troubled bargaining relationship with the employer; hence the employees were given an opportunity to select a new bargaining agent which might be more satisfactory. (Yale & Towne Manufacturing Company, NLRB)

* *Non-Discrimination Prerequisite to Certification*

As a condition prerequisite to the possible certification of a union, the board laid down a non-discrimination rule against Negroes. The employer had objected to the union's certification, since the union refused to admit Negroes into the bargaining unit. The union claimed that it would represent Negroes if they obtained certification. Since the board found no evidence of discrimination by the union, it claimed the union had the right to certification if it won the election; however, if the union later showed discrimination, the certification would be canceled. (Carter Manufacturing Company, NLRB)

* *Election Invalidated*

Because a union announced on the day before an election that WLB had approved an increase which involved the union's assistance, NLRB set aside the results of the election. While the employer held back this announcement in order to maintain his own neutrality, the union spread the news that all the employees were to receive a wage increase, although the approval affected only about 30 percent of the workers. The board withdrew its approval for the time being, and deemed the union's action as an interference with the free choice of the employees. (Seneca Knitting Mills, Inc., NLRB)

* *Court Enjoins Board Election*

A federal district court enjoined the holding of an election which NLRB had directed, after it had found in a representation proceeding that a union was a successor to a company-dominated union, and denied it a place on the ballot. The court was of the opinion that the board had overstepped its statutory authority in that it deprived the successor union of the right to appeal to the courts since only orders issued in complaint cases may be brought before

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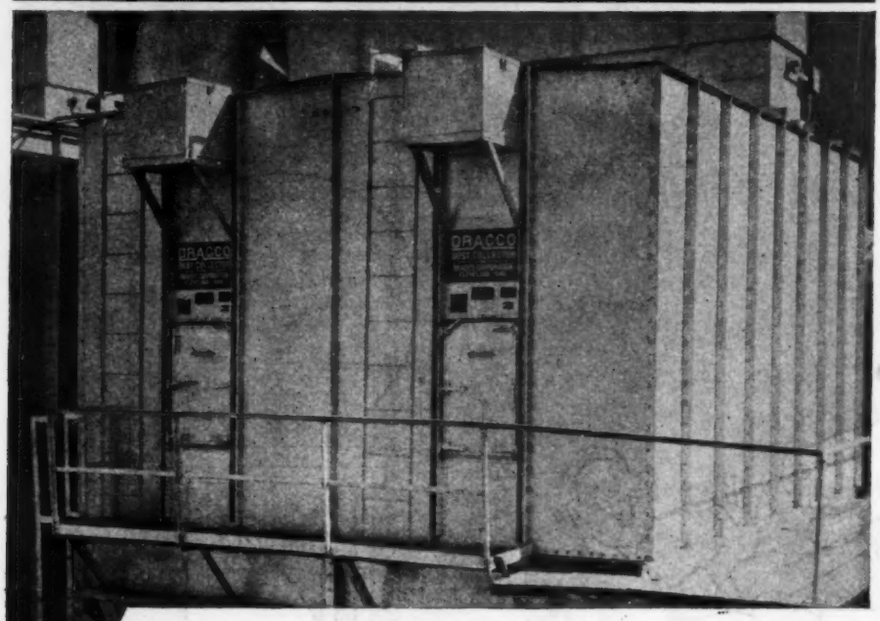

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the courts. (Brotherhood of Transit Employees, USDC Md.)

Election Upheld

Where defamatory statements made against an employer did not serve to coerce the employees in their choice in an election, the board held that sufficient grounds did not exist to set aside the election. The board pointed out that the employer had his remedy elsewhere for any defamatory statements made by unions before the date of election. (R. R. Donnelly & Sons Company, NLRB)

** Appropriate Unit*

Where the guards perform monitorial duties, are deputized, and carry firearms, they are excluded from units of production and maintenance employees, since they may be required to assume a position adverse to that of the ordinary production and maintenance employees. On the other hand, guards who are not deputized nor armed may join the same unit as industrial employees, provided their wages, hours, and working conditions are similar to those of the other employees. (Ingalls Shipbuilding Corporation, NLRB; Chicago Rawhide Manufacturing Company, NLRB)

** Back Pay Ordered*

NLRB granted award of back pay: (1) To two union employees who voluntarily quit upon being transferred to night shift work when day shift work was available; and (2) to a group of employees who were locked out by their employer to compel them to withdraw from the union. In the latter instance, the back pay was awarded despite the fact that, although charging interference, the board did not charge discrimination, which is the usual basis for back pay. (United Growers, Inc., NLRB; Central Minerals Company, NLRB)

** Unions Held Responsible for Minority Groups*

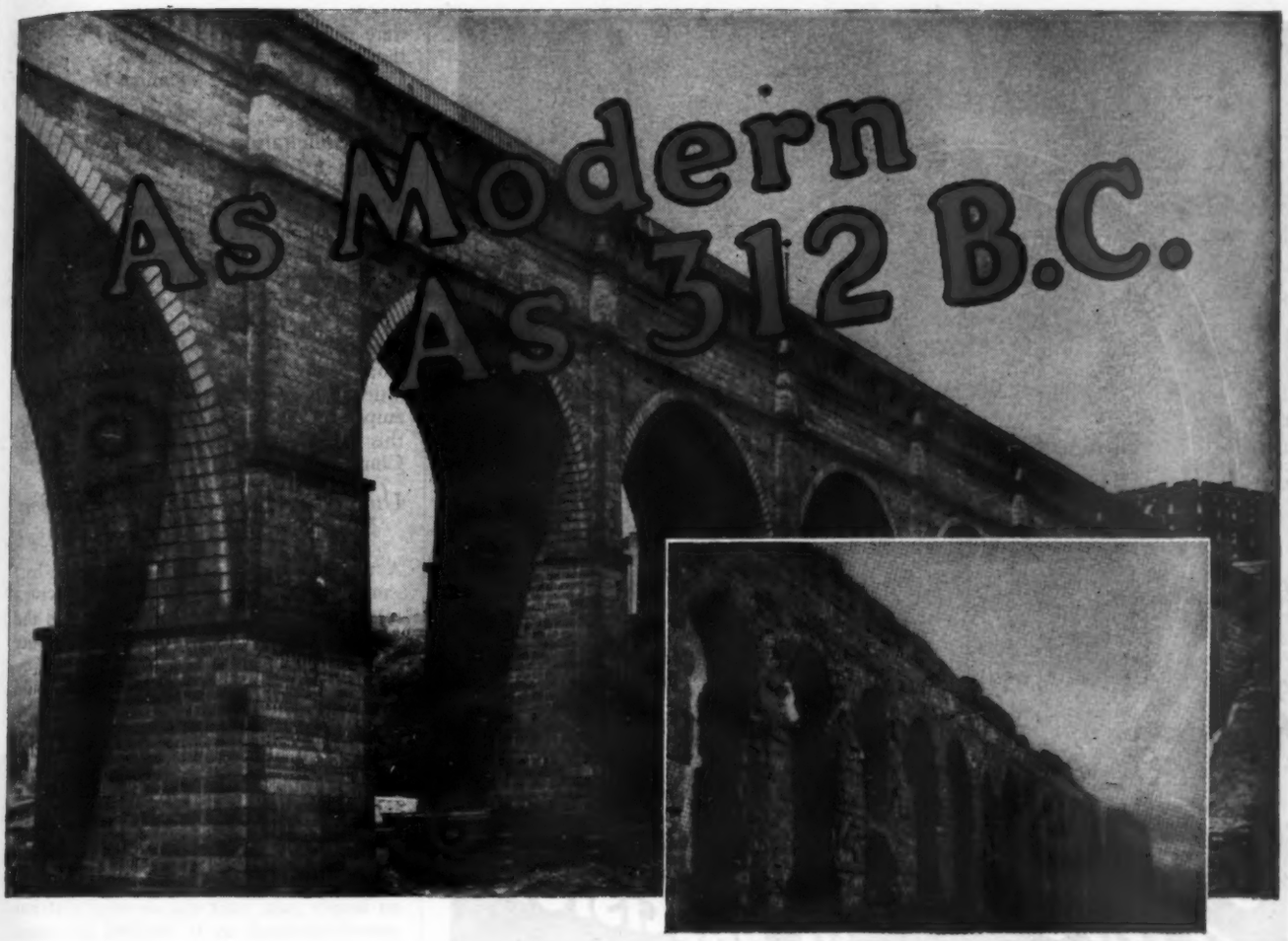
The Supreme Court upheld NLRB's finding of unfair labor practice where the employer executed a closed-shop contract with an unaffiliated union, knowing beforehand that the union would deny membership to CIO employees because of their union affiliation. The court also affirmed the board's order of reinstatement with back pay for those CIO members who were discharged pursuant to the union's demand on the consummation of the contract. In the course of its decision the court also pointed out that:

1. A bargaining agent is responsible for representing the interests of all employees fairly and impartially.

2. Despite the existence of a closed shop, no employee may be deprived of employment because of his prior affiliation with a particular union. (Wallace Corporation vs. NLRB, U. S. Sup. Ct.)

** Union Solicitation Barred*

A rule barring union solicitation was held to be in violation of the Wagner Act only so far as it prohibits union solicitation off the selling floor during non-working hours. The board agrees that if such solicitation



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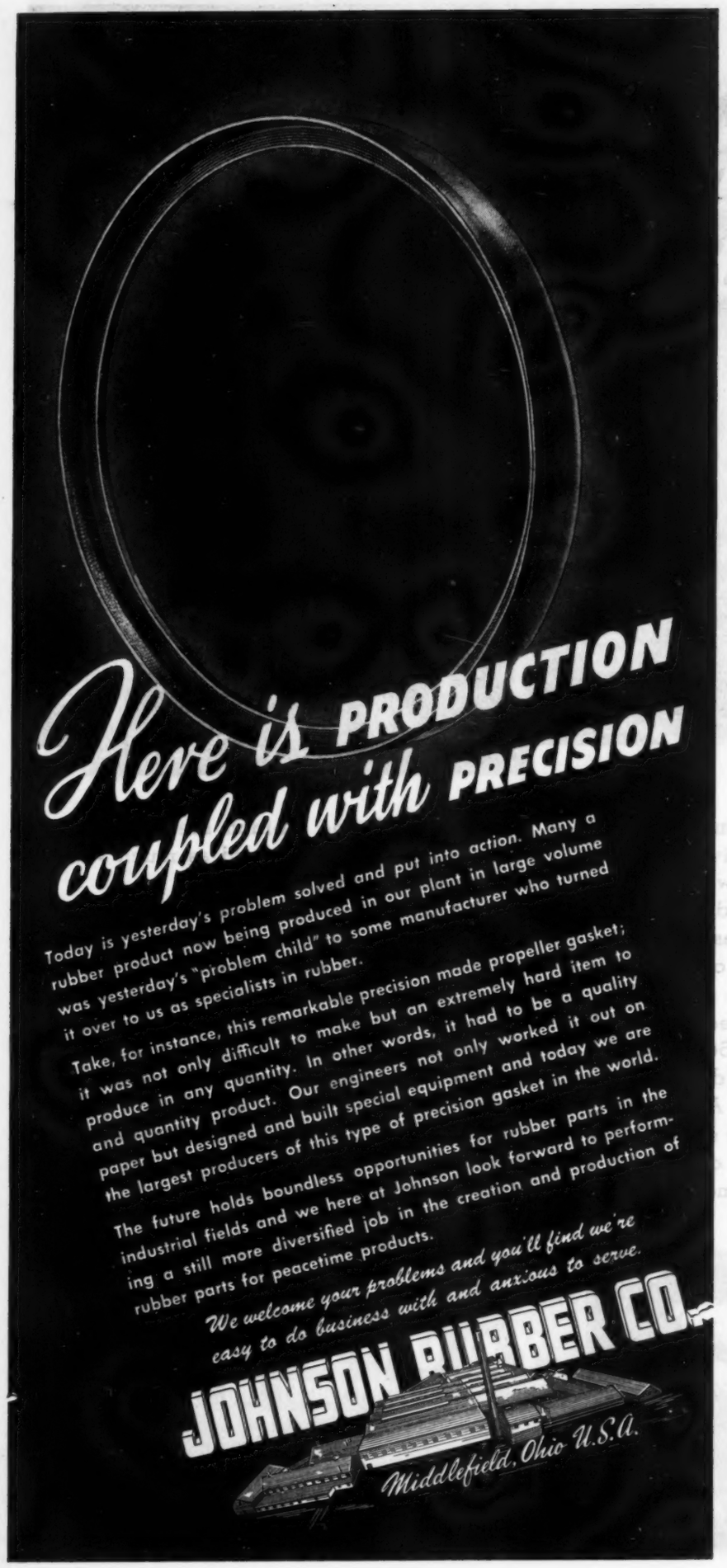
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were carried on while customers were on the floor, it might conceivably disrupt the employer's business. (Famous-Barr Company, NLRB)

* *No-Solicitation Rule Not Enforceable*

While a rule prohibiting union solicitation on the employer's premises outside working hours may be enforced against union members where they have renounced this right in a contract, the employer has no right to enforce this rule against employees who are not covered by the contract. Those employees so exempt from the rule were ordered reinstated with back pay when the employer discharged them for violating this no-solicitation rule. (Famous-Barr Company, NLRB)

Union Disqualified by Supervisory Members

A union will not be disqualified as bargaining agent because it admits supervisors into its membership. It is only when the supervisors outnumber the non-supervisory members, or the supervisors seek to influence the union, that the board would disqualify it. (California Packing Company, NLRB)

* *Employer's Unilateral Action Held Interference*

Action by an employer in transferring engineering employees, who had designated a union to represent them, from a salary to an hourly paid basis was deemed discriminatory inasmuch as it resulted in certain disadvantages which they did not incur as salaried employees. The board also found the employer's insistence on making the transfer without dealing with the union as a refusal to bargain. Retransfer to a salary basis, plus back pay for any losses incurred by the first transfer, was ordered. (General Motors Corp., NLRB)

Held Refusal to Bargain

Bypassing the lawful bargaining agent to secure unilateral permission from WLB to grant a wage increase was deemed an unlawful refusal to bargain. Despite the fact that the board had certified the union as bargaining agent, the employer refused to bargain with it on the ground that it was not an appropriate unit. In sustaining the board, the court pointed out that the board made its finding as to the appropriate unit after a full hearing, and that it was not arbitrary, and, therefore, must be accepted by the court. (NLRB vs. May Department Stores Company, CCA-8)

Held No Discrimination

An active union employee was held lawfully discharged when he left his work to participate in a private business. Although he asked for a 30-day leave of absence, he left before his request was answered. The board justified the discharge on the ground that an employee who chooses the time to work in effect informs his employer that he deems his job unimportant. Nor was the discharge unlawful where the employee, seeking a release so he could obtain another job, was absent repeatedly, and often left work early. In the latter case, evi-

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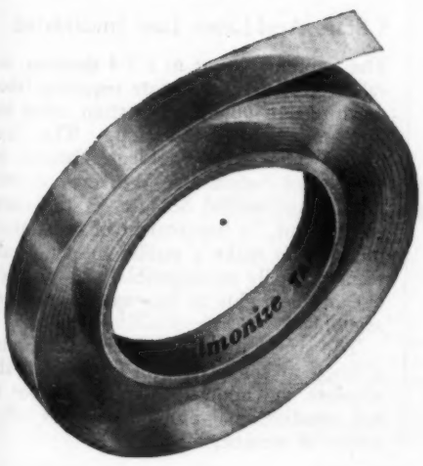

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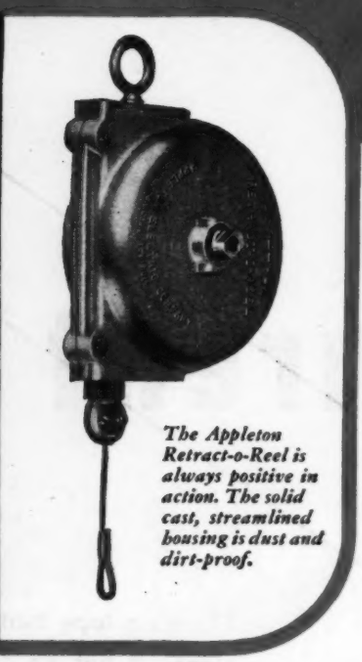

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dence was presented to show that the employer was aware of the employee's union membership. (Logan Clay Products Company, NLRB; Marquette Metal Products Company, NLRB)

* *NLRB Paramount in Unfair Labor Practice Case*

The Circuit Court of Appeals ruled that NLRB "is under no compulsion to conform" to the policy which NWLB would have followed. The employer claims that in a dispute such as had arisen, the parties are required by the WLB to resort to the grievance and arbitration procedure established under the collective bargaining contract and that the NLRB should follow the same rule. The court pointed out that the objective of NLRB is to free interstate commerce "from the burden of unfair labor practices" and it has exclusive jurisdiction over such practices, despite other means of settlement. Hence the dispute in issue is in no way governed by NWLB policy favoring arbitration. (NLRB vs. Walt Disney Productions, CCA-9)

* *Board Order Denied Enforcement*

The Circuit Court of Appeals held that an employer may lawfully refuse to bargain with a union representing plant-protection employees who constitute an appropriate bargaining unit. The board should administratively refrain in the public interest from enforcing the bargaining rights of such employees since the company was involved in war production and the interests of the employees as union members might conflict with their enforcement of regulations for the protection of the plant. (Jones & Laughlin Steel Corp., CCA-6)

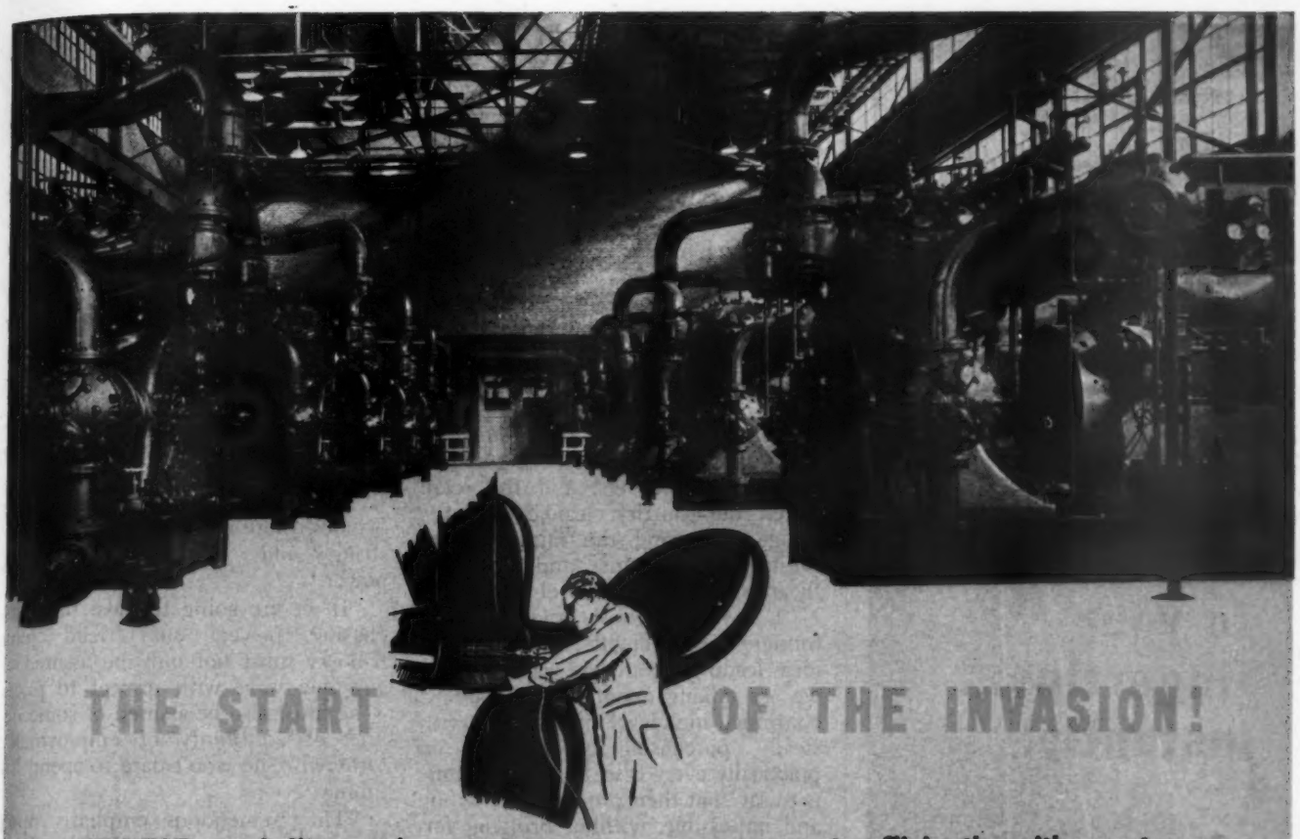
* *Jurisdiction of State Board Sustained*

In a situation involving two distinct orders of the New York Labor Relations Board and WLB, which did not conflict, the New York Labor Relations Board was held not to have lost jurisdiction over a dispute which was referred to and decided upon by WLB. The state board had ordered the employer to bargain with a union and reinstate two illegally discharged employees while WLB had ordered a contract between the employer and the union, but had made no mention of reinstatement. The court enforced the order to bargain, but set aside the order of reinstatement. (N. Y. SLRB vs. Union Club of City of New York, NY App. Div.)

* *State Anti-Labor Law Invalidated*

The Supreme Court in a 5-4 decision, invalidated the Texas statute requiring labor organizers to obtain registration cards before soliciting membership. The law, under which CIO President Thomas, of the United Automobile Workers was convicted, was invalid because, as the court pointed out, "a requirement of registration in order to make a public speech would seem generally incompatible with an exercise of the rights of free speech and free assembly."

The strong dissenting decision indicates a swing in the pendulum away from the absolute and unqualified right of labor to full constitutional protection in its solicitation of membership.



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"For years theorists and social reformers have brought forward certain ideas leading toward the very objective we are talking about today—namely, continued high-level employment with steady purchasing power—and in practically every case all we have done is to say that their proposals are wrong and impossible, *without bringing forward any counterproposal of our own.*

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"We have used up millions of pages of good paper to explain why we *couldn't* do for the working man what somebody else thought ought to be done for him. But have we used a single page to say what we *would* do for the workingman if we had a chance to do it?

"All right, gentlemen, what *would* we do, if we had that chance?

"Let's talk about John Sabosky. He's a worker in a factory. The other side says to him, 'We want to give you a living wage, security against unemployment, and insurance against old age.'

"And what have we told John Sabosky to date? We've said to him, 'John, old man, we think very highly of you. We hope we will always have work for you. But of course we can't guarantee how much work you will have. It all depends on conditions. As a matter of fact, we may have to lay you off at any minute. We like you, John, very much. But you must understand that business is business, and we can't continue to keep you on the pavroll one minute after your continued employment might threaten dividends to our stockholders.'

"Gentlemen, how long do you think we can expect to get general public support for that kind of philosophy?

"Now let's forget all about public support. Let's forget about the political implications of this situation. Let's consider John Sabosky purely as a buyer of the things which we must produce and sell, in order to continue to make an adequate living for our businesses.

"In the old days, before mass production, unit costs were in direct proportion to volume. But under our present mass production system, unit costs go down as volume increases.

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"If we are going to have that purchasing power, our friend John Sabosky must not only be assured of a proper wage with respect to prices—he must also be assured of some degree of *continuity of employment.* Otherwise, he won't dare to spend his money.

"The tremendous emphasis upon the question of security that has been evident throughout the New Deal history is not merely a New Deal idea. The fact is that a certain degree of economic security is necessary to support our mass production system. The question at issue is as to whether this degree of security can best be supplied by the government, under a system of regimentation and control, or whether it can best be supplied by private enterprise, operating under a free economy.

"Now, if we are going to be the champions of a competitive system under a free economy, we had better make sure that this system of ours does, in fact, supply the employment continuity and the economic security that is needed to sustain the system which we recommend.

"Suppose I translate this philosophy, for a moment, into a specific case.

"Suppose one of you men is offered a job by a president of a large corporation.

"You say, 'How much do I get?'

"Suppose the chairman of the board answers, 'You get $100 a day.'

"Your immediate answer would be, 'You mean $36,500 a year.'

"What would happen if the chairman of the board said, 'Oh no, I'm not talking about any assured yearly rate. I mean you get $100 a day, when you work. Of course we can't tell how long the job will last, and besides, you might be laid off on a Thursday.'

"What would you say? Well, can

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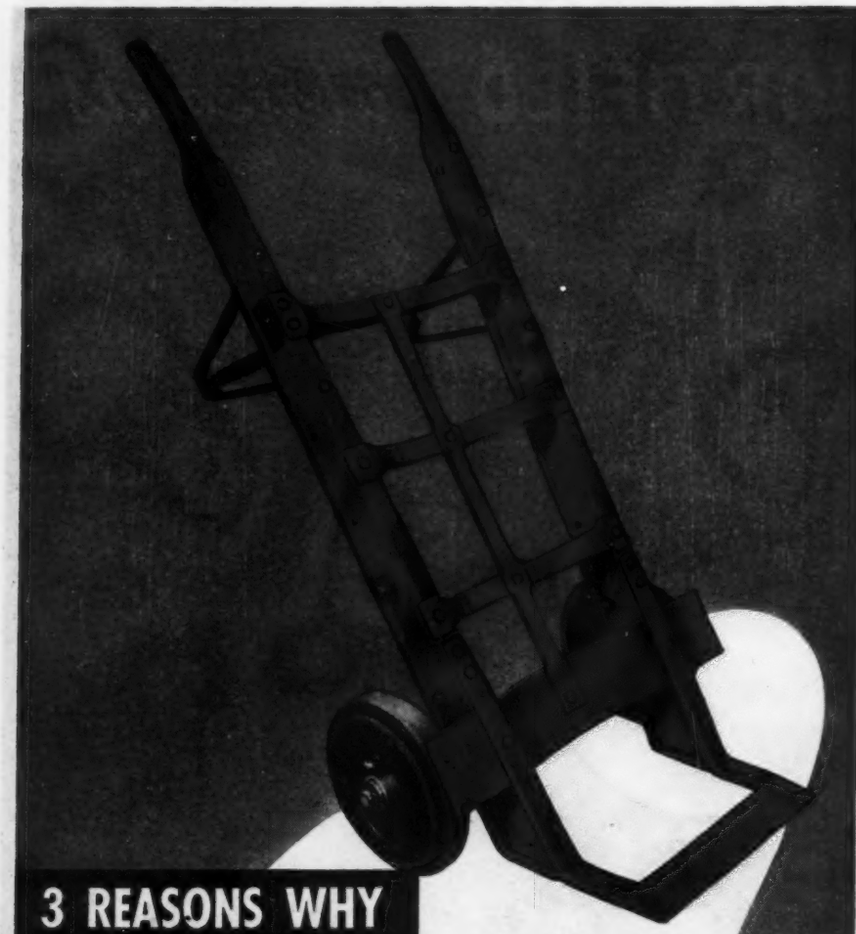

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PRESSED-STEEL
HAND TRUCKS

you blame John Sabosky for feeling any different from the way you would?

"Here is something else. When an industrialist fires a stenographer in his office, he gives her two weeks' pay. But John Sabosky may be laid off without notice. Why? The boss knows the stenographer. She represents, to him, a human being. But John Sabosky, out in the plant, is merely a number on an employment record.

"Until we can develop in our factories the same degree of personal relationships that all of us have long since adopted in our offices, we are never going to get a proper concept of the long-term responsibility of industry and business.

"And I am wondering what would happen if employers would put the same degree of study into how much money they could make by keeping men employed, as in past years they have put into trying to find out how much money they could make by reducing the number of their employees.

"Let's go back to John Sabosky again. His job folds up. The simple thing to do is to lay him off.

Find Another Job

"But suppose the employer said, 'Now wait a minute; isn't there some place in which we could continue to keep John Sabosky on our payroll, and still break even on what we pay him? For that matter, isn't there some way whereby we could find some other job for John Sabosky to do, on which we could actually realize a profit?'

"How much would it actually cost him to keep John Sabosky on the payroll? Remember, on the average, direct labor accounts for only 17 percent of the sales price.

"The mass buying power of our United States lies in the payrolls of the John Saboskys; and every time one single John Sabosky gets laid off, that means that the chances of American industrialists and businessmen to make a sale of their products is discouraged by just that degree.

"If we are going to succeed in maintaining the volume of post-war business needed to sustain high-level employment, we have got to sustain the high-level employment that makes possible the purchasing power required to buy the products of our businesses.

"Gentlemen, I know that's the old question of the hen and the egg. But the differentiation in this case is public opinion.

"Nobody can say which comes first —payrolls or purchasing power. But we can say and *should* say, in my

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(SMALL DIAMETER)

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For Further Information on Flamenol Building Wire, see the nearest G-E Merchandise Distributor or write to Section W152-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn., for descriptive folders.

* Reg. U.S. Pat. Off.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news, every weekday 6:45 P.M. EWT, CBS.

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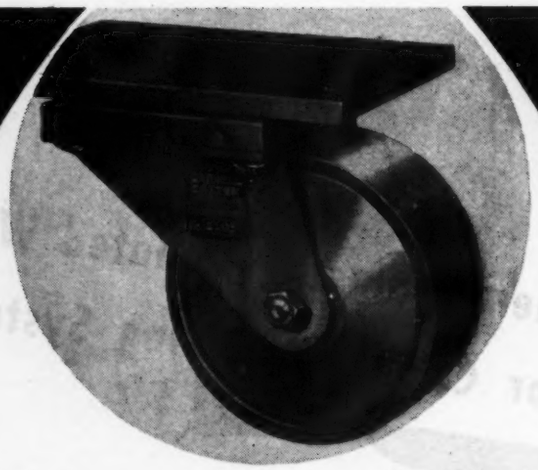

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opinion, that the philosophy of industry and of business is that employment should be maintained at the highest possible level.

"That much at least we can do—and I think we can live up to that philosophy by endeavoring to use, in the future, just as much ingenuity in keeping the largest possible number of men on the payroll, as in pre-war years we sometimes used for exactly the opposite purpose."

•

An Employment Budget

(The following is reprinted from the January, 1945, issue of The Bank Letter, *published by the National City Bank of New York.)*

A legislative proposal made public December 17 by the War Contract Subcommittee of the Senate Military Affairs Committee, "for the purpose of stimulating discussion," embodies a government program for making full employment a government policy. The substance of the proposal is that the President, along with the regular budget estimates transmitted to Congress each January, should also transmit estimates of the following:

1. The number of jobs needed during the ensuing fiscal year to provide full employment; also the dollar volume of the national product, at the expected level of prices, needed to provide the stated number of jobs.

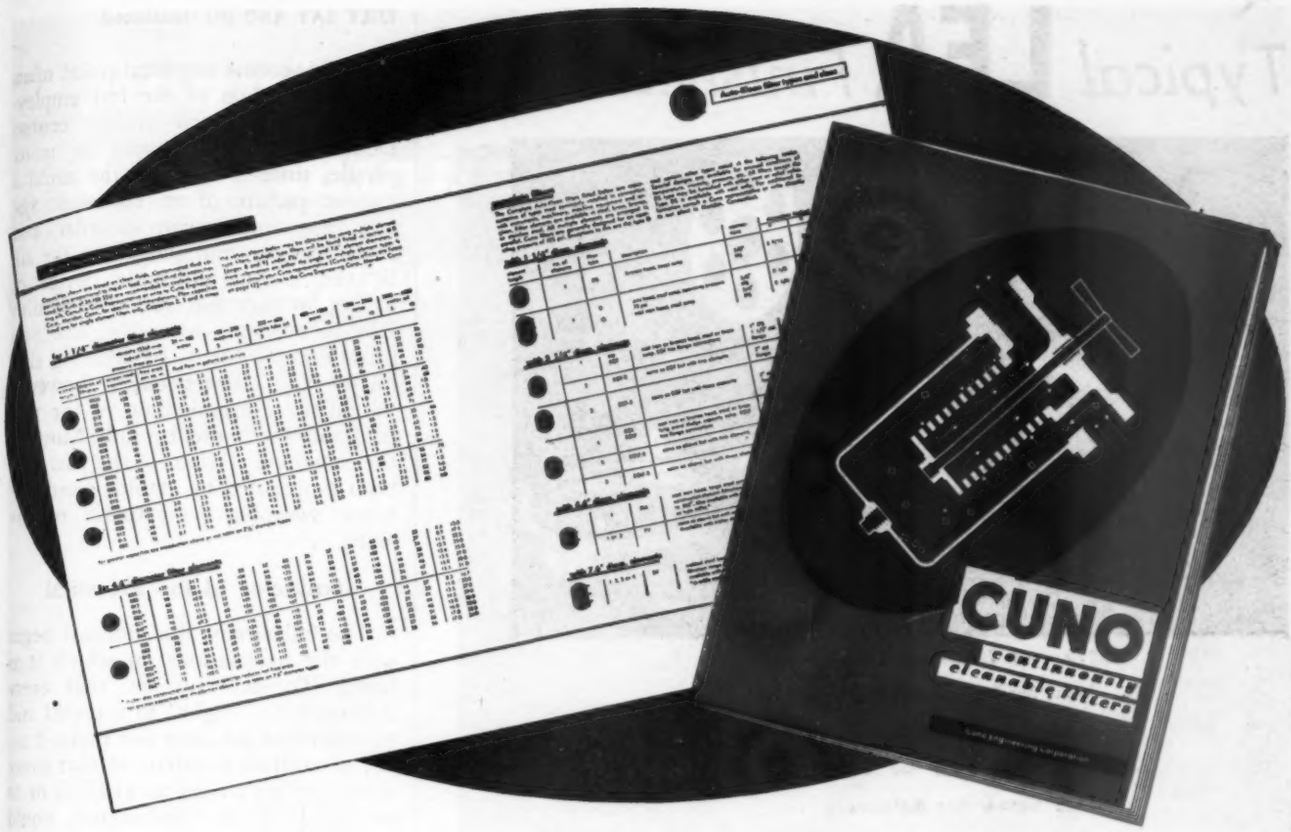
2. The volume of investment and other expenditure by private enterprise and governmental bodies required to assure the stated national product.

3. The volume of investment and expenditure by private enterprise and governmental bodies that is actually expected.

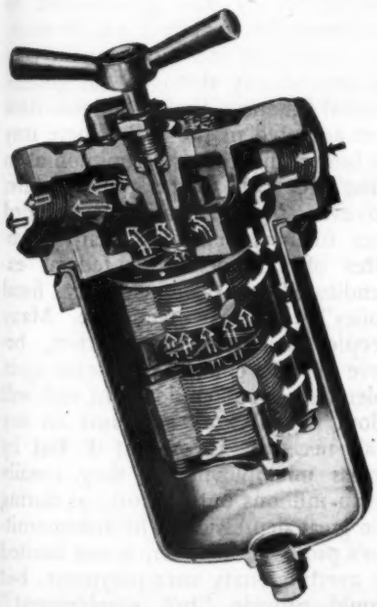
The proposal further provides that if the estimated prospective expenditure is less than the volume required to assure full employment, the President shall set forth a program (1) for encouraging non-federal expenditure, and (2) for making whatever volume of federal expenditure shall be necessary to fill the gap.

The proposal includes two declarations of policy—(1) that every American able and willing to work has the right to a useful and remunerative job, (2) that it is the responsibility of the government to guarantee that right by assuring continuing full employment.

If this proposal receives serious attention and debate in Congress, it is



HOW TO SELECT THE FILTER THAT KEEPS FLOW ON "GO"



Send for this catalog of filter selection factors and specifications on Cuno Continuously-Cleanable Filters. (It's in SWEET'S MECHANICAL, PROCESS AND DESIGN FILES, but you may like an extra copy.) It gives you the information you need, arranged according to the recommendations of SWEET'S catalog designers, who learned from men like you how you want such information furnished.

In a word, the Cuno Continuously-Cleanable Filter handles full flow without requiring any more space than ordinary partial-flow types . . . filters as fine as 170 mesh equivalent (finer with certain models) . . . filters continuously, even while being cleaned . . . is applicable to low pressure or gravity feed systems (as well as others) . . . is all-metal, non-collapsible, permanent . . . is compact and lightweight . . . never needs to be disassembled for cleaning or renewing. May be equipped with motor to make cleaning completely automatic.

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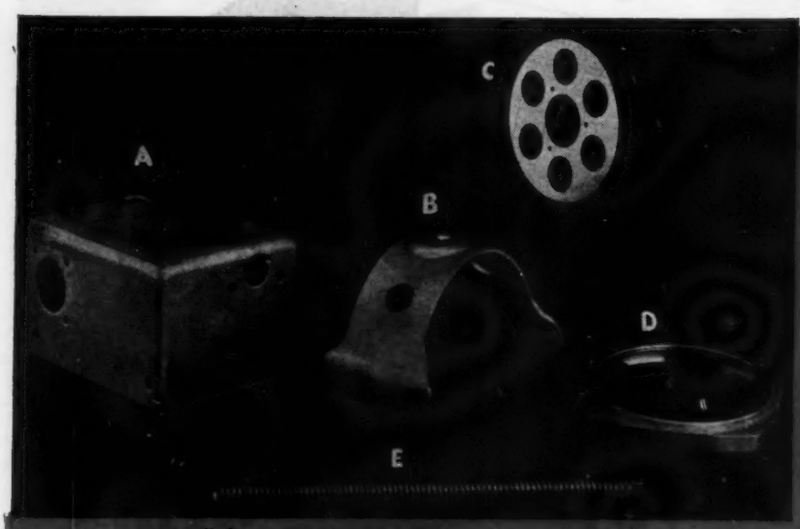

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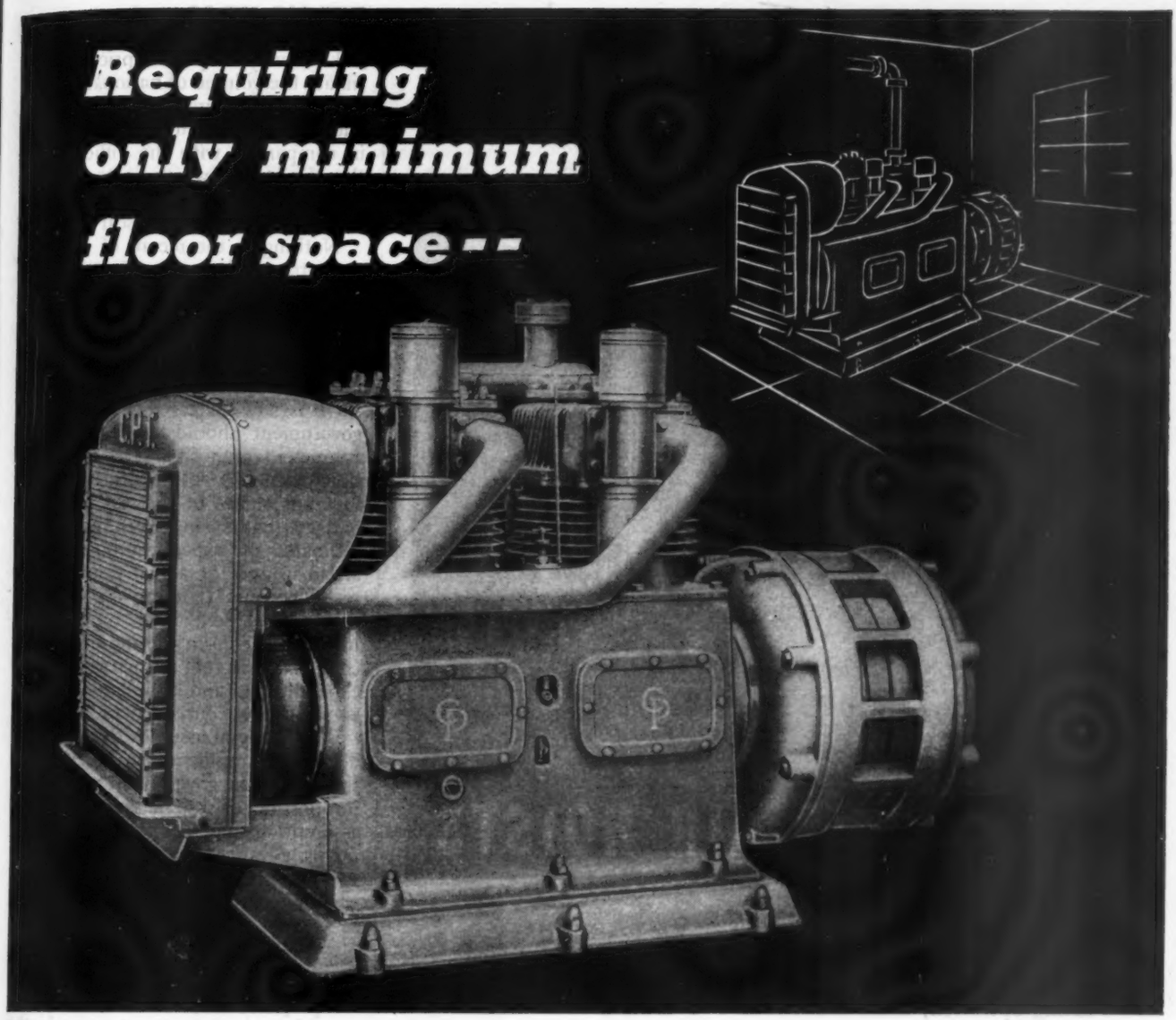
likely to become the focal point upon which discussion of the full employment problem will finally center. Doubtless it will appeal to many people, since it raises in the mind a graphic picture of an economic system kept continuously in order, and providing jobs and prosperity for all, by the seemingly simple device of having an overhead authority furnish jobs to everyone who does not find private employment. Its seeming simplicity and attractiveness, however, should make examination of the proposal all the more careful. Most of the economic illusions of the past have been propagated by graphic word pictures, sweeping sympathetic readers along.

Fallacies of the Proposal

The fallacies of the proposal begin with the declarations on which it is based. To state by law that every American has "right" to a useful and remunerative job does not make it so, any more than a statement that every American has a right to $10,000 or to an annual trip to Washington, would make it so. The government can confer benefits upon people only if benefits are practicable. The question is whether it is practical for the government to provide jobs, and if so at what cost.

The declaration that it is the responsibility of the government to guarantee the right to a job by assuring continuing full employment goes far beyond any statement of governmental functions that Americans have ever accepted in the past. There may be honest differences of opinion as to what they will accept in the future; however, the declaration as worded goes further even than many advocates of "compensatory federal expenditure" or "compensatory fiscal policy" think is practicable. Many people, including conservatives, believe that the country will never again tolerate mass unemployment and will adopt federal work programs on any scale necessary to prevent it. But by "mass unemployment" they usually mean millions out of work, as during the great depression. The subcommittee's proposal, however, is not limited to averting mass unemployment, but would provide "full employment," which is another conception.

Under the proposal full employment would be numerically defined by the President, of course with the aid and counsel of the statistical agencies of the government. The pitfalls in attempting to measure full employment numerically would be fewer than the difficulties of the President's second



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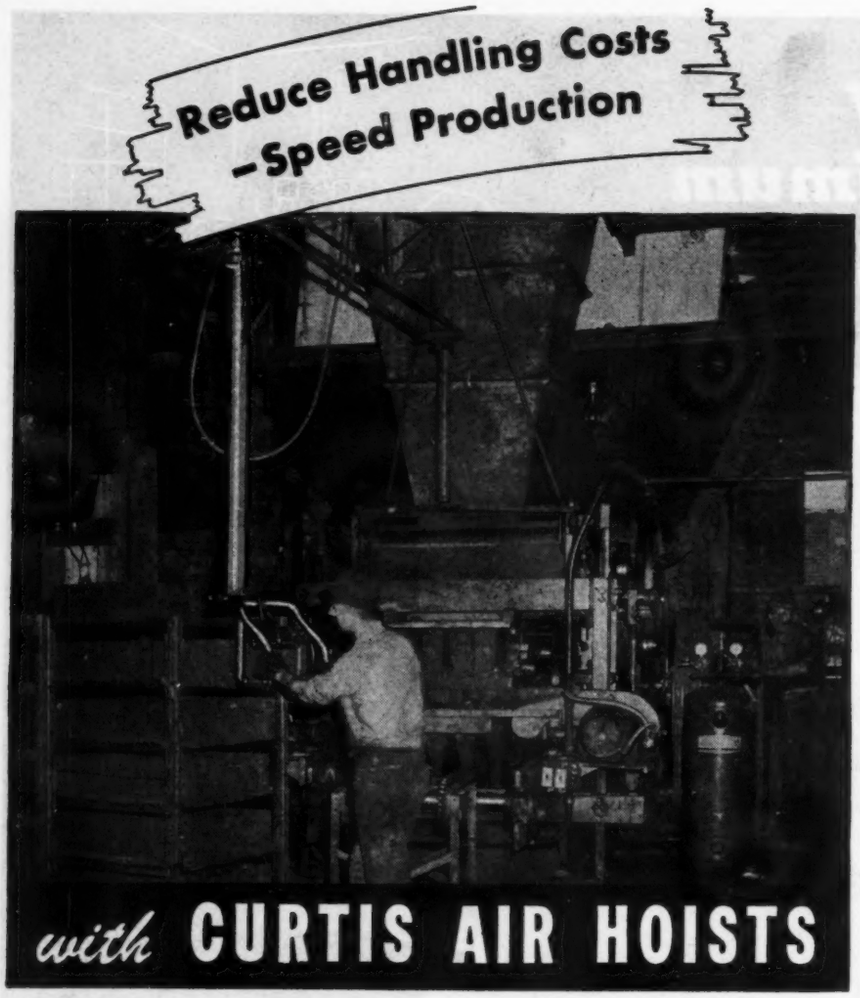

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task—namely, to predict prices and estimate the volume of national product required to assure full employment; and they would be utterly insignificant in comparison with the difficulties of the third task, which is to estimate the volume of expenditure actually to be expected during the fiscal year.

Nothing in the record of statistical projection and prophecy justifies a belief that such estimates could provide a guide reliable enough to warrant the government undertaking—on their showing—policies having such potentialities for evil as well as good. If there is any subject upon which the government should be a supremely competent authority, it is in estimation of its own expenditures. Yet in four out of five of the last peacetime budgets (ending in 1939) the January estimates of expenditures one year ahead missed the actual results by 14 to 32 percent. If it can do no better in its own field, how much worse might it not do in the infinitely more complex task of estimating private expenditures, and how much graver would be the consequences.

The proposal assumes throughout a degree of omniscience and foresight on the part of the government which cannot possibly exist. The same erroneous assumption underlies the broader proposals, advanced by some, for general overhead planning and control of economic activity.

The "Make-Work" Idea

The most fundamental fallacy of the proposal lies in the fact that if the provision of employment is made the primary function of economic activity, and the government is required to supply jobs, the cost and usefulness of the work done will be the subordinate consideration. Under such a policy it must be expected that "made work" would be carried on, the term signifying work which neither serves an economic purpose nor is self-supporting. The costs would fall on all business and all the people, either through taxes or inflation of the government debt. Or the government might engage in activities intended to be self-supporting, but competing with private enterprise. In either case private investment and expenditure would be discouraged and the gap to be filled by government expenditure would be widened. There would be set in operation a vicious circle whose logical end would be steadily increasing totalitarian controls and destruction of private enterprise.

It is urged that what the government does in war it can do in peace. But the costs of the war have not

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yet been paid, and there is no valid evidence that government can do in peace what it can do in war except with the same enormous waste, gigantic cost, and inflationary danger associated with war. It is sometimes said also that if Germany could provide full employment before the war, the United States can do so. But the German economy before the war was essentially a war economy, devoted to armament production. The inflationary consequences were repressed by regimentation and strict controls, including depression of wage rates and suppression of labor unions—in short, the Nazi system against which we are fighting.

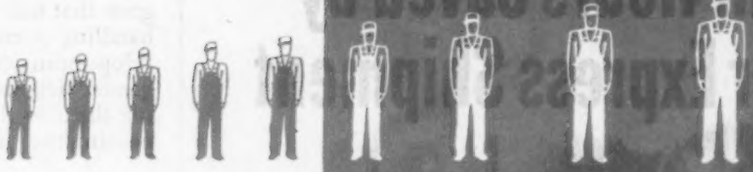
The responsibility for employment is a responsibility of everyone—of labor not to price itself out of jobs and to give full work for full pay, of employers to conduct their businesses with vision and enterprise, seeking to serve the people by making more and better goods at lower costs, and of the government—not to "make work"—but to provide the environment under which investment can go forward and enterprise function.

•

Post-War Future of Suggestion Plans

What about the post-war prospects of suggestion plans? Tremendous—unlimited, say those having years of experience in this field, according to F. A. Denz, administrator, suggestion plan, Remington Rand, Inc., Buffalo. "Our post-war problems will create the opportunity for applying practically the lessons from this greatest and most destructive of all wars. New materials and new products, many of which will completely change our mode of living will come to light—we shall be seeking new markets, new outlets for business. The thinking of our countless millions of American soldiers of production, proved so effective in our most trying times, can and will be used to advantage in the development of a new era—the post-war era. This American ingenuity can and will be used to help solve our post-war problems of production, living, and creation of jobs, through the development of new uses for our present as well as recently developed raw materials and products.

"Farsighted business has become alert to the tremendous possibilities of the suggestion system. Its value is recognized by industry and considerable study is being given to ways and means of creating an effective pro-



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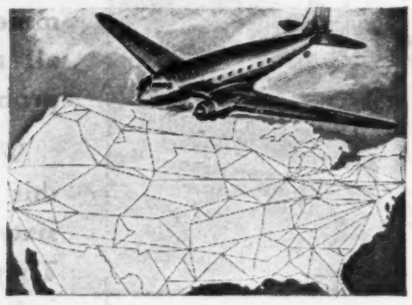

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gram that will insure fair and impartial handling of employee ideas and to develop means of spurring employees to greater heights by constantly reminding them of the ever-present need for constructive, intelligent suggestions."

•

Longer Hours Usually Mean Decreased Efficiency

Studies by the Bureau of Labor Statistics, made by Max D. Kossoris and reported in U. S. Department of Labor Bulletins 791 and 791A, of the effects of long working hours show that hours worked beyond 40 or 48 per week result in additional output, but at the price of continuous decreases in efficiency and marked increases in absenteeism as hours rise. A point is finally reached at which the longer work schedule is no more productive, and actually may be less productive, than a shorter work schedule. With few exceptions, the longer working time in the plants studied resulted in a general slowing down, not only during the added hours but throughout the entire work week.

Another point illustrated by the survey is that the 7-day week, as a steady program, is uneconomic and may actually result in less production than a 6-day week.

Among the 12 metal-working plants studied, the operations varied from foundry and forge-shop work to bench operations which required the processing of metal parts weighing as little as 1 ounce. There was no intention to study metal-working operations exclusively; it simply happened that long working hours were found most frequently in these industries. The material worked, however—whether metal, or wood, or leather, or paper, or any other substance—is of no great significance. Given the same types of exertion requirements, control over speed, and wage incentives, the work performance under the same hours schedules will probably follow much the same patterns.

Hours in Relation to Output

The surveys make clear that there is no such thing as an "optimum hour schedule" for all of industry. What appears to be a satisfactory schedule of hours for a plant with light machining operations may be economically wasteful in a foundry. Further, there is a marked difference in the performance of men working under wage incentives and those working at straight hourly rates without any kind of wage incentive. Much depends on the type

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6 Scraper Blank

For that time when the "heat's on"—and you need carbide tools rushed to the job "same day" or *same HOUR*—keep a stock of STANDARD Carboloy Blanks in your tool crib. Leading plants following this practice are ready at a moments notice to braze Carboloy Blanks on special tools or cutters and promptly meet emergency demands.

Adaptable to practically all styles and sizes of tools and cutters—including many vital tools for *ammunition production*—STANDARD Carboloy Blanks provide flexibility, economy and convenience. Stocked in grades for cutting steel, cast iron, non-ferrous metals, Carboloy "Standards" cover from 60% to 80% of all machining requirements.

Carboloy tool specialists will be glad to assist you in making a selection of Standard Carboloy Blanks for greatest "universal" use in your plant. Send for Catalog GT-175R.

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LOOK FOR THIS STARTER

In the RED PLASTIC can

IT LEADS THEM ALL

Pat. Nos. 2200443-2228210

Locks Out . . . Resets AUTOMATICALLY

1 Positively cuts out deactivated, flickering, blinking lamps.

2 When trouble is detected the starter automatically cuts off current to the ballast and lamp.

3 Gives long life to ballast because defective lamp is locked out. Prevents overheating.

4 When Lloyd AUTOMATIC locks out defective lamp—turn off the current—Remove defective lamp—Put in a new lamp.

Allow at least one minute to make the above change of lamps. Turn on the current. The starter automatically lights the new lamp.

NO NEED TO DO ANYTHING TO THE STARTER.

5 Lloyd NEW PLASTIC CAN has higher dielectric strength, is stronger, lighter, distinctive.

6 Knurled rim on plastic can insures positive grip for insertion and removal of starter.

7 Plastic can is sealed. No projecting lugs to cause trouble.

8 The life of the AUTOMATIC starter is many times greater than that of the average lamp.

9 It saves maintenance costs and power consumption, protects and insures longer life to the ballast and lamp.

10 Tested in production and prior to shipment to insure perfect performance.

Lloyd Automatic Available in FS-40 and FS-100

LLOYD PRODUCTS COMPANY

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of work and the requirements it exacts from workers, the degree to which workers can control the speed of operations, and incentives which motivate them—whether volume of pay, participation in the war effort, labor relations, or working conditions generally.

The available evidence indicates that, on the whole, the 5-day week and 8-hour day are more efficient than a work schedule with longer hours. That does not mean, however, that longer hours are not productive. There is little sacrifice of efficiency, for instance, if a sixth day of 8 hours or less is added.

When Hours Are Raised

The sharper break comes when daily hours are raised from 8 to 9½ or 10 or 11, provided the workers operate under an incentive-wage system. The primary effect of this lengthening of daily hours for workers on the day shift, when the 5-day week is maintained, is to wipe out the midweek spurt. The analysis of daily production patterns in several plants under a 40- or 48-hour schedule shows a building up of hourly efficiencies toward a peak on the third and fourth days of the week, with a slight drop thereafter. When daily hours were lengthened to 9½ or more, however, this peak disappeared. The production curve for the successive days of the week flattened out and any one day was about as good as any other day. When a sixth day was added, the line of production remained flat, but dropped to a lower level. The data indicate clearly that workers adjust themselves to longer hours by slowing down, not because they want to, but because they have to.

For workers on the second or night shift, the pattern is somewhat different. Their daily efficiency performance under the 8-hour day and 5-day week looks much like that of the day shift on the 10-hour day. There is practically no midweek spurt, and production tends to flatten into a fairly level line. The reason for this appears to be that these workers are somewhat tired when they come to work, having been up for some hours and probably at work around home. In any case, they are not so refreshed when they come on the job as the men on the day shift who have their leisure hours after, not before, the day's work. When a sixth day is added to stretch the week to 58 or 60 hours, the result is likely to be a steady decline in the efficiency level, day after day, with the peak points on Monday or Tuesday, at the very beginning of the week.

These "fatigue patterns" furnish a

Consistently Closer Duplication

MEANS CONSISTENTLY BETTER TOOL AND CUTTER SHARPENING

The extra effort Bay State makes to duplicate, on each order, exactly the specifications you have determined are right . . . pays off in cutting tool performance.

"Fractional grading"—an exclusive Bay State manufacturing method—offers a more precise selection of wheel hardness. Within the range of each regular grade, Bay State offers three fractional grades. Once you "fit the grade to the grind", you can be much more sure of duplicating exactly the wheel you want.

Also with Bay State grinding wheels, you get the advantages of Bay State's vitrified bond—an extra-strong bond that permits more open structures. Such wheels run cooler and faster. Other types of vitrified and resinous bonds are available for any need. Bay State's "Koolpore" gives you an extremely open and porous wheel — especially suited for cemented carbides.

Send for complete details and tables — ask for Bulletin F containing description of Bay State's 6A and 8A for production grinding of duplicate parts, and "Koolpore" extra-cool cutting wheels. Bay State offers a complete line of bonded abrasive products and individualized engineering service.

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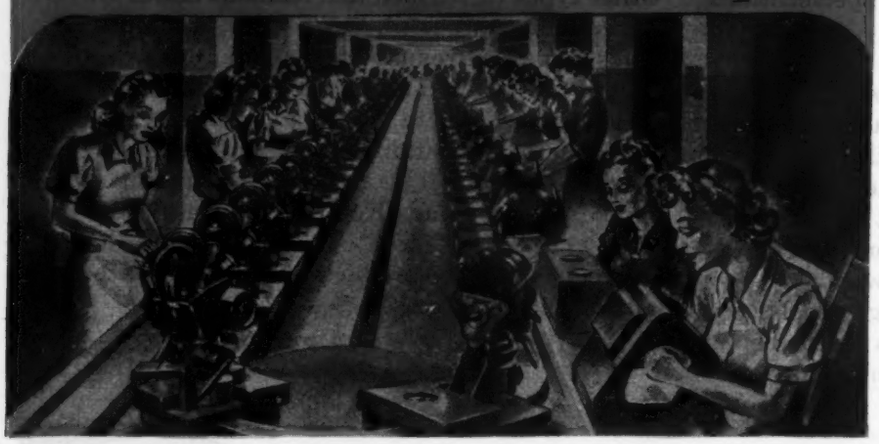
ABRASIVE PRODUCTS
Top Performance Consistently Duplicated

GRINDING WHEELS · HONING AND SUPERFINISHING STONES · PORTABLE SNAGGING WHEELS
MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS · AND CYLINDERS

2⅔ Day's Production *Every Day!*



LAMSON *Conveyors*

Nearly Tripled the Output of Magneto Coils for Aircraft . . .

MORE PLANES! That plea was passed along the line to all the factories contributing to aircraft production. One, a leading manufacturer of magneto coils, asked **LAMSON ENGINEERS** how he could possibly shorten assembly time from his low of 40 minutes. They found the solution in a **LAMSON** Carrousel Conveyor — running at a constant speed — moving the work in production — making possible an even flow — increasing efficiency — eliminating confusion and pile-ups around the machines. This smoothly functioning production-line method cut to 15 min. the time for the job that had formerly required 40!

LAMSON UNIFICATION didn't stop there! The assembled magneto is then placed on a slow-moving Overhead Conveyor for a 7½ hour test run. It is delivered next to a second Carrousel Conveyor, where it is disassembled, inspected, reassembled, final-inspected, and shipped.

This, and many other installations, are illustrated and described in the free book we've prepared for you. Mail coupon today!

LAMSON CORPORATION

ARMY E NAVY

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Yes — I'd like to read the FREE BOOK "Case Histories to Aid You in Blueprinting Conversion to Peace." Please send my copy to —

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Company.....

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City..... State.....

reasonably accurate basis for anticipating, for incentive-wage workers, the result of changing (a) daily hours from 8 to 10, or from a 40-hour week to one of 50 hours, and (b) from this level to a still higher one, by adding a sixth work day. The first change may cause a decrease in efficiency of about 5 percent; and the second, of 7 to 10 percent if hours do not exceed 58 or 60, but may be as high as 20 percent if hours reach 66.

For men on straight daywork rates, the lengthening or shortening of hours seems of considerably less significance. This was observed in two foundries. In one, daily scheduled hours remained at 10, but the sixth day was dropped. In the other, daily hours during a 6-day week were raised from 8 to 9½. In each plant the hourly efficiency level remained essentially unchanged under the different levels of hours. Apparently the pace at the shorter hours was not so fast that the addition of extra hours caused a slowing down; nor did the shortening of hours bring about any quickening of the work tempo.

In plants in which work was light or very light, the general tendency for workers under incentive systems, and with weekly hours ranging between 55 and 58, was to produce about a 2-hour volume of production for every 3 hours added about 48 per week—i.e., 6 days at 8 hours each. When work was heavy, as in foundries, the ratio was more nearly 1 hour's additional output for every additional 2 hours worked. One reason for this was the greater need for rest pauses.

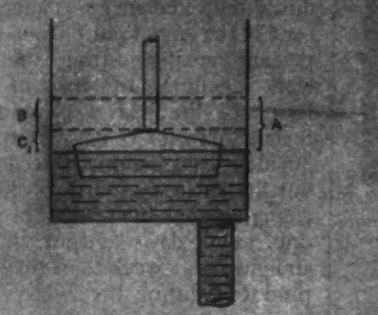
Shorter Hours, Equal Output

The studies included two plants in which shorter hours were found to result in a volume of output as great as, or greater than, was the case under longer hours. In a forge shop, where the work was both hot and heavy, a 52-hour week was found to be as productive as a 58-hour week. In a shell plant, in which morale was excellent and the work medium heavy, the lengthening of daily hours from 8 to 10 for the day shift and 11 for the night shift, and of weekly hours from 40 to 60 and 66, had such unsatisfactory results that the plant eventually changed to a 48-hour week. The average increase in output under the longer schedule was only about 7 percent above that for the 40-hour week—a result which could have been achieved easily by increasing weekly hours from 40 to 43 or 44. The additional 20 hours were sheer waste of time.

The experience of one plant which had operated extensively on Sundays

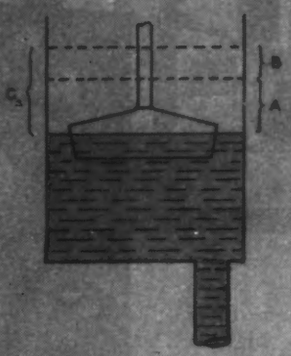
METER-MAKING STRATEGY LICKS TEMPERATURE ERRORS!

FIGURE I — FLOAT IN HIGH-PRESSURE CHAMBER

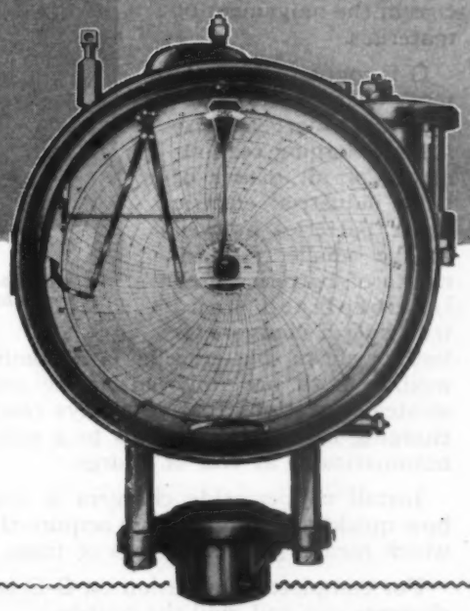


A — EXPANSION ERROR
B — DENSITY ERROR
C — TOTAL OR NET ERROR

FIGURE II — FLOAT IN LOW-PRESSURE CHAMBER



Any temperature change tends to cause two inherent errors in differential meters. One is due to *volumetric* change in the mercury; the other, to *density* change. Figure I shows how Foxboro minimizes temperature error by placing the float in the high-pressure chamber. Expansion error *A* is practically cancelled by density error *B*, leaving only negligible net error C_1. Figure II shows what happens with float in the low-pressure chamber. *A* and *B* are additive, producing combined error C_2.



Foxboro Engineering disproves practice of locating float in low-pressure chamber

Every detail of a Foxboro Flow Meter illustrates why you get "more meter for your money" when you buy a unit that is systematically engineered, instead of put together on a basis of fixed habit.

Foxboro's "strategy" of locating the meter float in the high-pressure chamber, rather than the low-pressure, is one of many typical examples. Based on broader understanding of basic principles, this simple design feature utilizes two inherent sources of thermal error to offset each other. The result is sustained accuracy throughout the range, winter and summer alike!

Even for your simple installations, it costs no more to get Foxboro Meters built with such exacting refinements throughout! Write for complete information. **The Foxboro Company, 24 Neponset Ave., Foxboro, Mass., U. S. A.**

EXCLUSIVE FOXBORO REFINEMENTS

- **Segmental Lever Transmission gives straight-line calibration.**
- **Extra-large Float with long travel for extra power.**
- **Sure-Seal Check Valves positively prevent mercury losses.**
- **Pressure-Tite Bearing eliminates stuffing box and packing.**

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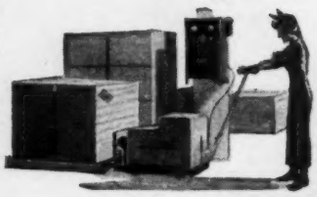
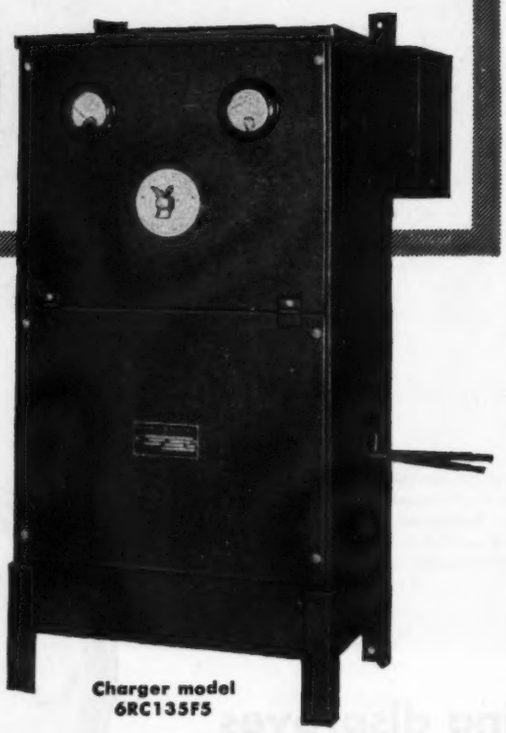
DIFFERENTIAL-TYPE FLOW METERS

A GOOD ELECTRIC TRUCK NEEDS A GOOD BATTERY CHARGER





Charger model 6RC135F5

Together they offer the answer to highest efficiency and lowest cost in the movement of materials.

G-E copper-oxide battery chargers are designed to meet the exacting charging requirements of all makes of large industrial electric truck batteries as well as the smaller requirements of batteries used in motorized hand trucks. G-E chargers for lead or nickel batteries or G-E combination chargers to accommodate both are fully automatic and easy to use. Spotted at strategic locations they're always ready to deliver an initial high charging rate which reduces to a safe finishing rate and cuts off automatically at end of charge.

Install copper-oxide chargers in truck working areas . . . see how quickly truck operators acquire the "Noon Hour" boost habit which means greater savings of time, labor and battery power.

For complete information on G-E low cost copper-oxide battery chargers clip and mail the coupon.

BUY WAR BONDS AND KEEP THEM

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

Appliance and Merchandise Department
Section A254-37
General Electric Company
Bridgeport, Connecticut

Gentlemen:

Please send a copy of the new G-E electric truck battery charger catalog, publication No. 52–46.

Name.....

Address.....

City.....State.....

GENERAL ELECTRIC

under a 7-day weekly schedule demonstrated the undesirability of continued Sunday work. While remaining on the 8-hour day, this plant worked a 7-day week for over a year. It then dropped every third Sunday, later every other Sunday, and finally every Sunday. The analysis of the plant's performance shows that efficiency was lowest during the 7-day week, and highest during the 6-day week when no Sundays were worked at all, and that efficiency mounted as additional Sundays were dropped. The data indicate that efficiency was about 36 percent better and total output about 13 percent greater during the shortest work schedule. In terms of this performance, the 7-day week amounted to 8 days' pay for 5 days' output. The 30 identical operators traced throughout the entire period involved in these changing schedules actually produced one more day's output during the straight 6-day week than they formerly produced during the 7-day week.

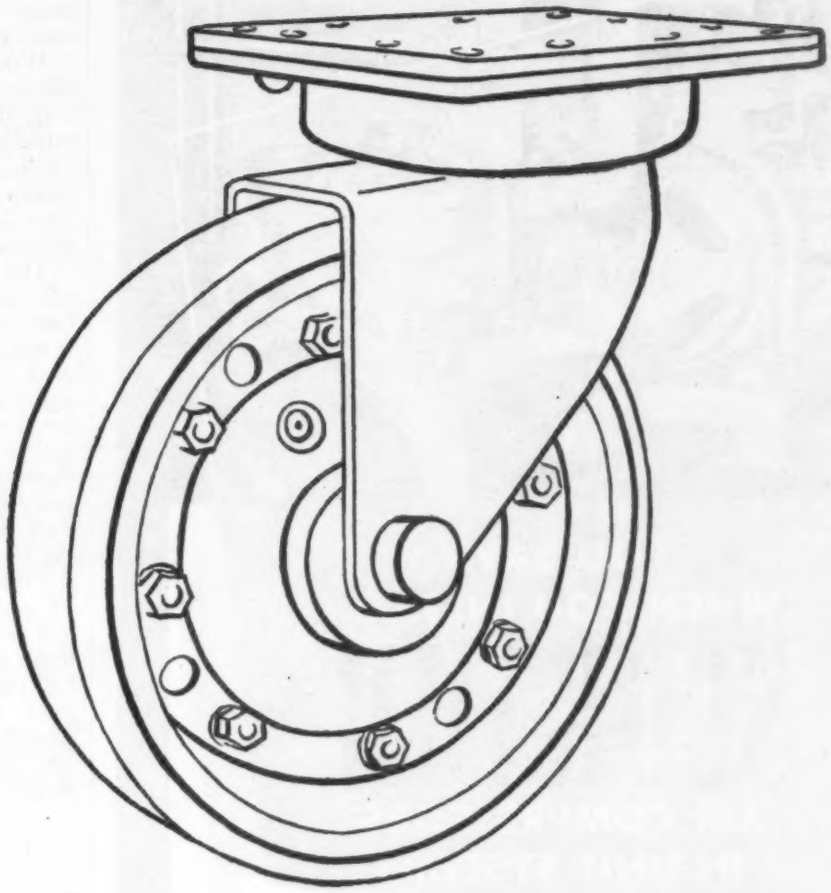
Hours and Absenteeism

The relationship between longer hour and absenteeism was found to be the same in nearly every instance—as hours increased, whether daily or weekly, absenteeism increased. In most cases the reasons could not be determined from plant records. Some of the data suggest a higher incidence of illness. In some instances it was quite clear that workers wanted or required more time for leisure or to attend to personal matters. It is also likely that the strain of longer hours and the fact that the weekly pay envelope was higher than it had been for years combined to induce workers to pay more attention to their health and well-being. The fact that workers were limited in the items their money could buy was also cited by some plant executives as a reason why men took more time out, or why they absented themselves for reasons which they would not have heeded under shorter work schedules and with smaller earnings.

As a rule, absenteeism was higher for the night shift than for the day shift under the longer work schedules. This was particularly true of women, whose absenteeism rates generally exceeded those of men.

Hours, Accidents, and Efficiency

In the absence of effective safety programs, work injuries tended to occur relatively more frequently under longer hours. In one plant they occurred only one-third as frequently when the daily hours were reduced from 10 to 8. Where plants had good,



CASTERS for YOUR PRODUCT

An idea for manufacturers of quality products.

As you proceed with the development of your postwar designs, CASTERS ARE IMPORTANT. For office machines, furniture, domestic appliances, industrial equipment—anything moveable—you should be certain that the casters you select will provide maximum service to the user.

Colson casters are built for quality products and will give long, trouble-free service.

Tell us your requirements and we will be glad to assist you in making the proper selection of the caster most applicable to your needs.

★ BUY U. S. WAR BONDS ★

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CASTERS · INDUSTRIAL TRUCKS AND PLATFORMS · LIFT JACK SYSTEMS · BICYCLES · CHILDREN'S VEHICLES
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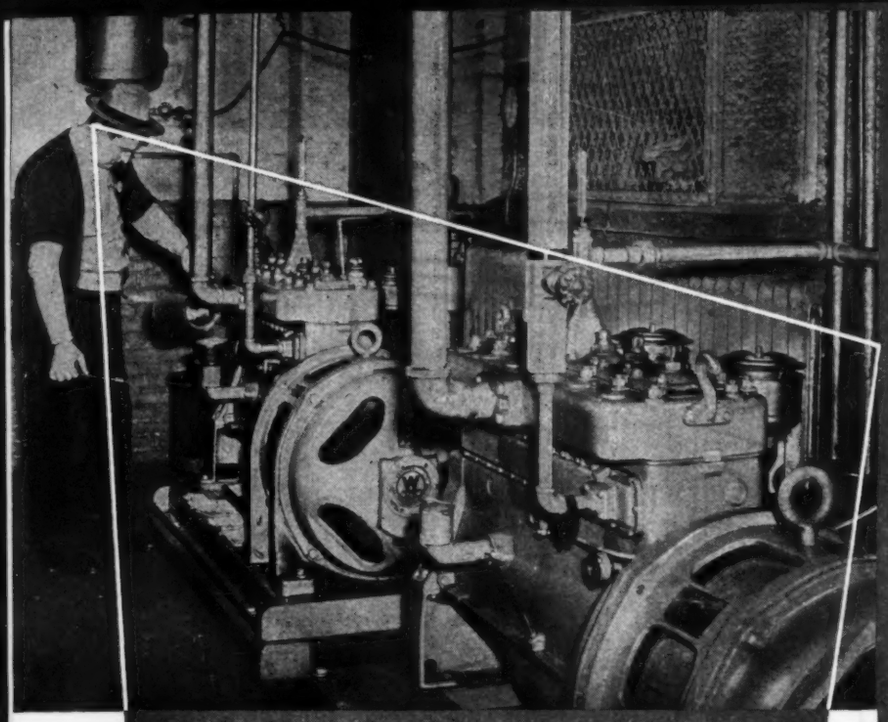


YOU SAVE
WHEN YOU INSTALL
SCHRAMM
AIR COMPRESSORS
IN UNIT SYSTEMS

Here is an interesting illustration of two Schramm Air Compressors at work, furnishing air in a plant where there is regularly a demand for medium amount of air—and an *occasional* peak load which requires a lot of electrical current and air. The two compressors take care of the *variation* of needs for much and little air.

Schramm compressors have 3 outstanding features that make them economical and easy to operate: (1) 100% water-cooled, (2) lightweight and compact, (3) vibrationless, even when providing great amounts of air.

These—and many other features—make Schramm Air Compressors the best compressors for your plant. Write today for full data.

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

active accident-prevention programs, the lengthening of hours did not bring about a disproportionate increase in work injuries.

Women were found to be more efficient than men at light, repetitive, and rhythmic operations requiring nimble fingers and little physical exertion. On the other hand, men were superior on machines which required close adjustments or which were complicated.

The merit of an incentive-wage system as a spur toward greater production was well observed in a foundry. It was found that the change from day-work to piecework rates resulted in slight increases in output even when hours remained at 10 per day and 58 per week. The result was dramatic when the introduction of the incentive coincided with a reduction in weekly work days from 6 to 5, even though the 10-hour day was maintained. Output during the shorter work week was 13 percent greater than it formerly had been under the 6-day week. In terms of the production level which had prevailed during the longer work week, the men—at piece rates—produced as much in 5 days as they formerly had in 7 days without a wage incentive.

•

Industry Men Can Learn How to Test Personnel

Indicative of probable closer relationship between industry and the engineering colleges is the new intensive course in personnel testing methods to be taught representatives of industry at Purdue University.

Methods developed at Purdue to test industrial personnel for job aptitudes are to be taught to industry men who enroll in the Purdue Industrial Personnel Testing Institute for classes from March 12 to 24. Concerning the testing technique and the classes, the university's announcement says:

"Purdue University has conducted research in personnel tests for a period of several years. Many different tests have been tried out in a wide variety of industrial plants. Thousands of applicants and men and women on different types of jobs have been tested. Several new tests have been developed to meet specific needs.

"The Institute is a special two-week intensive course specifically organized to bring this experience and these results in practical form to industrial personnel men and employment managers. This course is open to representatives of industries that now have a

Nation-wide Erecting and Maintenance Service

●

Offices in all Major Cities Look in Your Phone Book

Anchor Chain Link Fence says "Keep Out!" in any language. It shuts out trespassers, snoopers and trouble-makers . . . guards your plant's war and postwar secrets . . . controls traffic in and out of the plant . . . protects outdoor storage areas. Exclusive deep-driven "anchors" hold Anchor Fence erect and in line in any soil or weather . . . Anchor Fence is easy to take up and move to other locations if your plant area changes.

On *any* fence problem . . . including the relocating, realigning, repairing or painting of your present fence . . . let Anchor's 53 years of experience help you. Look in your phone book and call a trained Anchor Fence engineer . . . from one of our nation-wide network of sales and erecting offices. Send for our big illustrated Industrial Catalog. It's crammed with helpful fence information and ideas—and it's free! Just write any of our three factories: Anchor Post Fence Co., 6620 Eastern Ave., Baltimore 24, Md.; 1505 Gentry St., Houston, Tex.; and 616 S. Anderson St., Los Angeles, Cal.

ON ANY FENCE PROBLEM CALL ANCHOR

A CONVEYOR SYSTEM engineered by Alvey-Ferguson is virtually an endless-stream *indoor* transportation system that can take raw materials in one end of your plant and turn them out as finished products—shuttling them to storage banks or to and through the shipping rooms—even stacking them in box cars if you wish.

The A-F Chain Conveyor, shown above, handles heavy cast alloy boxes of stampings from the annealing furnace. It is only a small section of the *complete* A-F Conveyor System in a midwestern plant which enables operators to handle greater production with less effort—less fatigue—more efficiency.

Safety experts will be interested in the checkered plate walkway on either side of the live roller conveyor in which metal strips were welded to stabilize the footing of operators who have to cross it.

Greater efficiency in production is vital now as well as in the future. Write today for more information or a frank discussion of your production problems.

THE ALVEY-FERGUSON COMPANY
Offices in Principal Cities 132 Disney St. Cincinnati 9, Ohio
Affiliated Corporation
THE ALVEY-FERGUSON COMPANY OF CALIFORNIA
P. O. Box 396, Vernon Branch, Los Angeles 11, Calif.

CONVEYING EQUIPMENT
Alvey-Ferguson
METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

personnel testing program in operation or are considering the use of personnel tests. The course is particularly adapted for industries that are facing, or are likely to face, a difficult personnel program."

•

Electric Truck Bookings Fewer in October

Domestic bookings of electric industrial trucks and tractors during the month of October, 1944, totaled 142 units, according to figures released by the Electric Industrial Truck Association, 208 South LaSalle St., Chicago.

The net value of chasses only booked during October totaled $575,611.50, compared with $825,360.18 in September.

The October bookings included 2 platform trucks with capacities of 4000 pounds and prices ranging from $1930 to $1975, and a total net value of $3905; 125 cantilever trucks with capacities and chasses base prices ranging from 2000 to 16,000 pounds, and $1375 to $7475, respectively, and a total net value of $493,746.50; 5 light and heavy-duty tractors with chasses base prices ranging from $1650 to $1945 had a total net value of $9470; 10 crane trucks with capacities and chasses base prices ranging from 3000 pounds at 7 feet to 10,000 pounds at 5½ feet and $5480 to $8150, respectively, had a total net value of $63,490.

All net values are at factories after additions and deductions for variation from standard specifications, trade-in allowances, when applicable.

•

Help Third Shift Workers Adjust to Their Hours

Employers in North Carolina are finding useful an outline called "Third Shift Worker," which discusses the factors affecting the health and welfare of workers employed on the third shift. The outline was prepared by W. E. Ryon, state chief, Manpower Utilization for North Carolina, War Manpower Commission.

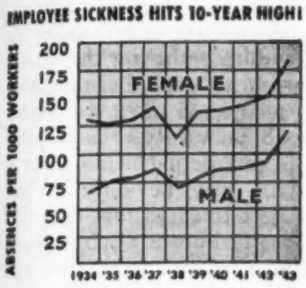
After a short paragraph of introduction which points out the increase in the number of third shift workers, and emphasizes that absenteeism among third shift workers is higher than among workers on the other two shifts, the outline continues:

It is believed that if some of the following information were in the hands of plant executives, nurses, and em-

No. 4 of a series on how vitamins work in industry

THE MISSING LINK

The absentee worker presents, to management, a grave and growing problem. Dramatic evidence of this lies in the chart below, revealing the sharp increase, over a ten-year span, of the frequency of disabling sickness among workers. The sicknesses here recorded are for 8 consecutive days or longer.



Data from reports of sick benefit associations, group insurance plans and company relief departments as compiled by Industrial Hygiene Division, U. S. Public Health Service.

Other figures, bearing on the same vital subject, stem from an N.A.M. survey of a representative sample of its membership, indicating a rise from the prewar absentee rate of 3.48% to a wartime average of 5.42%.

It is hardly necessary to elaborate upon what such figures mean to industry. One estimate alone states that an excess of 3 to 4% in absences in a highly tooled industry can mean an 8 or 10% reduction in production, each per cent in absence reducing production about 2½%.

MORE THAN MEETS THE EYE

"MINUS" MEALS

Frequently lost sight of among many of the more obvious reasons for absences—colds, fatigue, digestive upsets and such—is the spectre of bad diet.

That excessive fatigue, lowered resistance to colds, eye-strain, impaired efficiency and lowered morale *can* be attributed to faulty diet, may be assumed from the National Research Council's statement in its bulletin No. 110: "It is generally accepted that natural resistance to disease is dependent upon the body's nutritional state."

DIETARY DELINQUENCY

The same authority, the National Research Council, also states that "all evidence from numerous surveys is, without exception, that inadequate diets are widespread in the nation."

Is there not good reason, then, to believe that such a situation exists within your own company, your own employees?

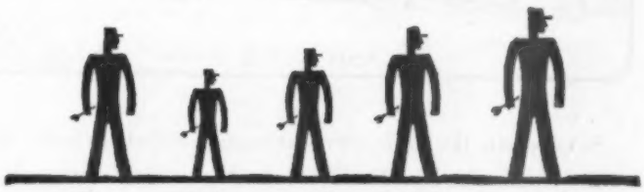
VIMMS INDUSTRIAL PLAN

SUPPLEMENT WITH VIMMS

To help protect workers against the debilitating results of defective diets, many industries—textile, chemical and numerous others—utilize the Vimms Industrial Plan in both plant and office. Inexpensive and easily organized, the Vimms program supplies all the vitamins known to be essential in the diet, *plus* all the minerals commonly lacking. Vimms make up the difference between what the average worker gets in his regular diet and what he should receive. (NRC Recommended Allowances for vitamins and minerals.)

Plants using the Vimms Plan report up to 90% of the workers enthusiastically participating in this vitamin-mineral supplementation program. For example, in a large manufacturing firm, employees taking Vimms regularly, returned questionnaires revealing:

TYPICAL EMPLOYEE REACTIONS



56%	51%	52%	56%	57%
APPETITES IMPROVED	FEWER COLDS	SLEPT BETTER	MORE PEP	LESS TIRED AT END OF DAY

Equally gratifying are results reported by other companies. Unreported, however, is the fact that the Vimms Plan also serves to guard against those prolonged nutritional deficiencies which might affect even the workers' later years.

TAILORED TO YOUR OPERATIONS

The Vimms Industrial Plan is carefully worked out between you and our trained industrial consultants and is custom-tailored to your own individual system of operations. Distribution trays, speakers for employees' meetings, posters and payroll stuffers are provided free with the plan.

WRITE TODAY FOR FULL DETAILS

Department of Industrial Research
Lever Brothers Company, Box 243-DF
50 Memorial Drive, Cambridge 39, Mass.

Gentlemen: Please tell me more about how the Vimms Plan works.

Name_____

Company_____

Address_____

OUT OUR WAY

I CONGRATULATE YOU ON LOWERING YOUR ACCIDENT RATE WITH SPEEDI-DRI!
LOOK AT OLD SAFETY SAM... ALL SMILES! AND WHEN WE TRIED TO GET HIM TO USE SPEEDI-DRI HE COULDN'T SEE IT!
HE'LL TAKE ALL THE CREDIT, TOO... WELL, WHO CARES? SPEEDI-DRI IS HERE TO STAY, NOW!
J.R.WILLIAMS
CASH IN THE BANK
T. M. REG. U. S. PAT. OFF.
COPR. 1944 BY NEA SERVICE, INC.

SPEEDI-DRI, the new, revolutionary, oil-absorbent, is lowering accident rates in hundreds of plants, cutting down on slips and falls, eliminating danger of fast-spreading fire. SPEEDI-DRI is a white, granular material that blots up oil, cheers up employees.

Spread on; SPEEDI-DRI provides an immediate non-skid surface. Swept off; SPEEDI-DRI leaves concrete, steel or wooden floors home-clean and dry. It requires no special machinery to apply, no elbow-grease or strong-arm work. One plant took two men off floor maintenance and put them to more valuable work, after discovering SPEEDI-DRI.

Send for a FREE SAMPLE. . . . SPEEDI-DRI for ordinary oils and greases, SOL-SPEEDI-DRI for soluble oils. See for yourself why leading companies are ordering in carload lots.

SUPPLIERS: East—Refiners Lubricating Co., New York 1, New York.
Midwest & South—Waverly Petroleum Products Co., Philadelphia 6, Pa.
West Coast—Waverly Petroleum Products Co., Russ Bldg., San Francisco 4, Calif.

SPEEDI-DRI
OIL AND GREASE ABSORBENT

"Think First—Stop Accidents"

ployment men, new workers especially could be instructed on techniques of day sleeping habits.

One of the basic criteria in successful day sleeping is regularity of eating, sleeping, and bodily care. The night worker should not change his schedule of sleeping during the day any more than he would for night sleeping. For example, if a worker sleeps one day up until time to go to work, and then tries to sleep the fore part of the following day, only 9 or 10 hours will have elapsed between the periods.

Avoid Too Much Sleep

Strangely enough, sleep over 8 hours will cause drowsiness and inability to stay awake during the night. From 6 to 8 hours seems to be the amount of time best adapted to night work. The worker should be warned to accomplish his sleep in one period planned for 8 hours. This may be difficult, but habit can be formed to that end. He should be warned not to sleep in chairs or on davenports, but to undress and go to bed normally as he would at night.

One of the greatest difficulties is hot weather sleeping. Schedule 3, on page 268, is drawn up to take advantage of the coolest part of the day, but is not recommended if one single period will suffice. An electric fan that causes circulation of air, but does not blow on the sleeper, is a help. The worker should choose the coolest room in the house, as long as such room is not made a thoroughfare.

He needs cooperation at home in keeping down disturbance. Normal noise does not bother a sleeper, but unusual sounds such as ringing doorbells or screaming children should be avoided. Bells can be muffled and children discouraged from playing near the room of a day sleeper. Some have found that they can eliminate noise by the use of cotton in the ears. The room in which the worker sleeps should be darkened as much as possible without cutting off the supply of fresh air. A dark cloth tied around the head over the eyes has been found helpful to some. Sleep is induced by some by reading in bed, but with others reading tends to keep them awake.

Many new workers who have been assigned to the third shift become discouraged because they cannot adjust themselves to day sleeping. It should be explained to them that such a change in habits must be acquired over a period of time, varying with the individual. The percentage of workers who cannot make such adjust-

The CONE AUTOMATIC MACHINE COMPANY

sees many

GOOD THINGS AHEAD

It is reported that . . . . . .

Through recent explorations our known reserves of bauxite (source of aluminum) have been increased by more than 100 million tons. *Science News Letter.*

get ready with CONE for tomorrow

The National Postwar Products Exposition is scheduled to open March first at the Chicago Coliseum. *Marcus W. Hinson, Ex. Mgr. 1513 S. Wabash Ave., Chicago 5.*

get ready with CONE for tomorrow

A new tractor-drawn farm implement plows, discs and harrows in one operation. *"Till-Master", Till-Master Mfg. Co., Portland, Oregon.*

get ready with CONE for tomorrow

Today's scientists have revived a four-thousand year old method of killing insect pests with fine dusts. These dusts adhere to the insect's skin or casing and interfere with its water balance. Death results from thirst. *Dr. H. V. A. Briscoe, Imperial College, London.*

get ready with CONE for tomorrow

A railroad now has one-hundred plywood box cars and one thousand on order. The weight saving is said to be about two tons per car. *Great Northern Railway.*

get ready with CONE for tomorrow

A new "de-barker" is being used in some pulp mills that removes the bark from logs by the force of a jet of water at 650 pounds pressure without removing any wood. The saving in wood is said to be as high as 20%. *Scientific American, Oct. 1944.*

get ready with CONE for tomorrow

The continuous injection molding of plastics is made possible by a new machine. *Chrysler Corp.*

get ready with CONE for tomorrow

A new electric iron requres no cord but absorbs heat from an electrically heated and thermostatically controlled base. *Eureka Vacuum Cleaner Co., Detroit.*

Jet propulsion may be used to power sailplanes and gliders and, in miniature, for flying models. *McGraw-Hill Overseas' Digest.*

get ready with CONE for tomorrow

A university engineer has announced the discovery of a new type of concrete, useful for building construction, that is stronger than steel and lighter than aluminum. *Northwestern University.*

get ready with CONE for tomorrow

A new $1,800, four-room house will come directly off the assembly line on to a truck for delivery. *"Wingfoot Homes", Goodyear Tire and Rubber Co.*

get ready with CONE for tomorrow

A "zipper" fastening has been developed that is claimed to seal in liquids and gases. *B. F. Goodrich Co.*

It has been stated that the weight of aircraft engines has been reduced about 40% since the beginning of the war. *Aircraft Yearbook 1944.*

get ready with CONE for tomorrow

Manufacturers of the "jeep" plan to sell it to farmers and are reported to have ordered 25,000 bodies for this purpose. *Willys Overland.*

get ready with CONE for tomorrow

A machine has been patented for making barrels out of cardboard for packing butter, flour, sugar, chemicals, fruits, or small parts. *Everett Industries, Akron.*

get ready with CONE for tomorrow

Aviation and electrical engineers are collaborating on an electric drive for aircraft. This will, if practical, permit the location of engines in the fuselage and do away with nacelles in the wings. *Hughes Aircraft Co. and Westinghouse.*

get ready with CONE for tomorrow

One of the country's largest grocery chains is planning to ship fresh fruits and vegetables to its markets by airplane. *A & P.*

Here is performance that is definitely AHEAD

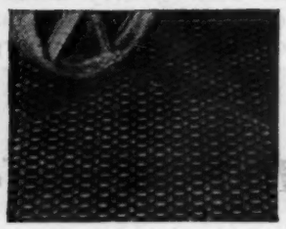
This part calls for extreme accuracy and yet requires wide forming cuts on a variety of diameters. In one position an attachment taps an inside thread 5/16"-18 while, at the same time, a die cuts an outside thread 5/8"-27. Produced on the 6 Spindle Conomatic at the rate of 12.5 seconds per part.

CONE

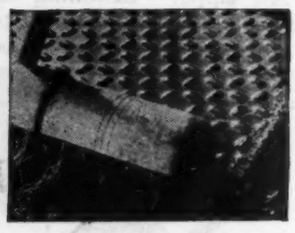
AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

SAFETY
This patented tread pattern, shown actual size, provides many skid-foiling buttons to grip and hold each shoe, every step. The flat-topped risers of Multigrip Floor Plate assure safe starts, turns and stops—wet or dry.

1. SAFE FOOTING



2. SURE TRACTION



3. QUICK CLEANING

...for men and vehicles

MEN are protected from injury, strains and fatigue by Multigrip Floor Plate. Vehicles roll easily, true to line—safely.

Laid over new or old concrete or wood floors, Multigrip Floor Plate furnishes complete floor protection. The safety pattern has no pockets to hold dirt and grease, is easily cleaned in any direction. Also drainage is quick and complete, no closed channels hold water. Speedy installation, long wear, minimum maintenance and low cost are some of the other advantages which have induced many plant engineers to install Multigrip Floor Plate.

Note the locations in your plant where mishaps, such as skids and falls, occur most frequently. Then make them safe by installing Multigrip Floor Plate.

For L.C.L. lots, buy from your local steel distributor

U·S·S MULTIGRIP FLOOR PLATE

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

ment is extremely small. The worker should not resort to drugs to induce sleep unless prescribed by a physician.

The worker who has completed his last night shift should have about 3 or 4 hours of sleep in the morning and then he can stay up the rest of the day and sleep normally at night. Going in on the first shift after sleeping nights, his best sleeping hours would be from suppertime until work time.

Care of the Body

All rules of health should be emphasized for the night worker. Regular eating and sleeping habits have already been mentioned. Constipation should be avoided, preferably by diet, and, if necessary, by drugs. There is no reason that night workers cannot get as much sunshine and fresh air as inside day workers. Some are fortunate enough to possess sun lamps. They are a help in short days as a substitute for sunshine. A worker should plan his habits and work around home out of doors.

As in sleeping, regularity should be stressed in eating. Avoid heavy meals just prior to sleeping periods. Eat plenty of fruits or drink fruit juices. The schedules below are designed to carry out these suggestions.

Based upon a shift running from 11 p.m. until 7 a.m., with the worker leaving home at 10:30 p.m. and arriving home at 7:30 a.m., the following schedules of activities are proposed:

1

7.30 a.m. . . . . Light breakfast
8 a.m. to 4 p.m. . . . . Sleeping period
5 p.m. . . . . Heavy meal
10 p.m. . . . . Snack or fruit juice

Night lunch at period allotted. Eat very lightly.

2

7:30 a.m. . . Breakfast—heavy as desired
12 noon . . . . . Lunch
1:30 to 9:30 p.m. . . . Sleeping period
10 p.m. . . . . Light meal

Night lunch at period allotted. Eat very lightly.

3

7.30 a.m. . . . . Breakfast—light
8 a.m. to 12 noon . . . . Sleeping period
12.30 p.m. . . . . Heavy meal
5.30 p.m. . . . . Light meal
6 to 10 p.m. . . . . Sleeping period

Night lunch at period allotted. Eat very lightly.

Schedule 1 has the advantage of an immediate rest when the worker arrives home. It also gives him a free evening with his family.

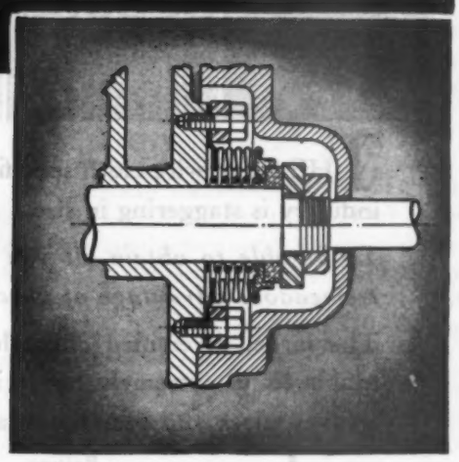
Schedule 2 gives rest to the worker

Now the WHOLE doughnut goes to work

WHEREVER there's danger of leakage of gas or liquid around a rotating shaft, there's need for a Sylphon Shaft Seal. Principles successfully applied to control problems for more than 40 years, have proved eye openers in this special field.

Basically, the application is very simple; a sturdy helical spring holds circular ring or *seal nose* firmly against a *sealing surface* mounted at the end of a shaft. A Sylphon Bellows provides a flexible, gas- and liquid-tight connection between a *mounting flange* and the *seal nose*.

Sylphon Shaft Seals are engineered for each specific application. Sizes range from seals for tiny instrument shafts to seals for huge military installations. Finely machined and balanced, they afford a perfect seal against pressures up to hundreds of pounds, operate at shaft speeds up to 400 RPM.



Sylphon Shaft Seal. Prevents leakage around a rotating shaft where the shaft extends from inside to the outside of enclosure.

New Movie—"The Story of Metal Bellows" is available to interested executives and organizations.

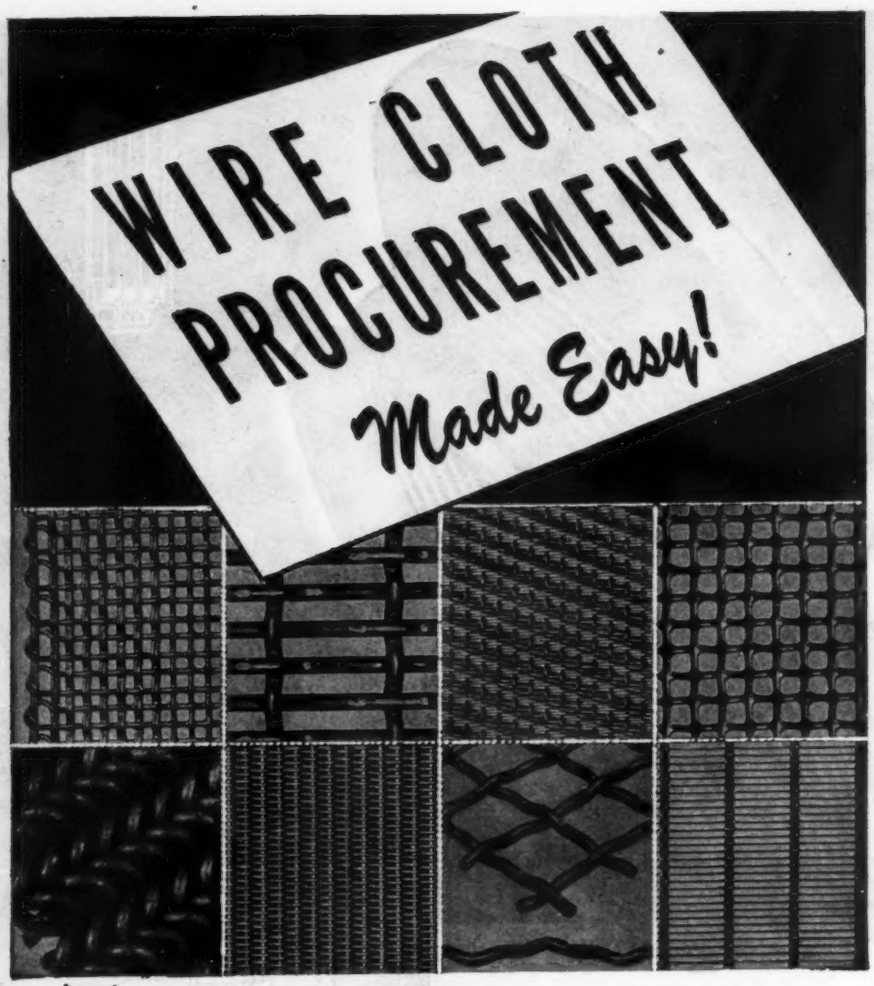
Write for Bulletin CF-825, giving as much specific information as possible about your problem.

FULTON **SYLPHON**

TEMPERATURE CONTROLS ... SEALING ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

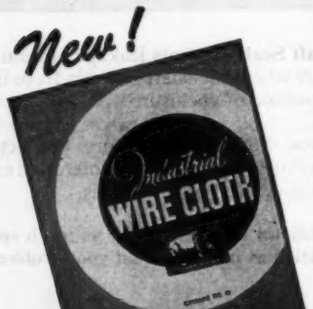
Canadian Representatives, Crosby Brothers, Montreal



THE list of wire cloth specifications required by American industry is staggering in size.

To be able to obtain all you need from one source is the tremendous advantage of checking first with Buffalo Wire.

The large, diversified clientele of this Company is attributable to an extremely broad range of standard and special weaves, sizes and metals for all applications:



Bolting	Guards
Sizing	Reinforcing
Sieving	Anodizing
Filtering	Ornamental
Grading	Panels, Grilles
Locomotive Stacks	Partitions
Separating	Enclosures
Straining	Riddles
Carburetion	Baskets
Processing	Trays
Conveyor Belts	Vibrating Machinery
Backing	and many special uses

56 PAGES OF MOST HELPFUL, COMPLETE, UP-TO-DATE INFORMATION EVER PUBLISHED

Write for new Industrial Wire Cloth Catalog No. 12

MANUFACTURER OF ALL KINDS OF WIRE CLOTH FOR OVER 75 YEARS

Buffalo WIRE WORKS CO., INC.

ESTABLISHED 1859 AS SCHEELER'S SONS

440 TERRACE BUFFALO 2, N. Y.

before starting his work period, and is less likely to cause sleepiness at night. This schedule is recommended for new employees.

Schedule 3 is a summertime schedule to take advantage of the coolest parts of the day for sleep. Broken sleep periods are not otherwise recommended. Once a schedule is started, it should not be changed before the end of the night shift work period.

In spite of all care that can be exercised, the average worker is more prone to "fly off the handle" when working nights. This fact alone calls for better supervision on the night shift. In addition, many companies assign new employees to the third shift and "promote" them to the second shift on a basis of seniority. This causes an added load on supervision at night, with such a proportion of untrained help.

Bonus for Night Shift

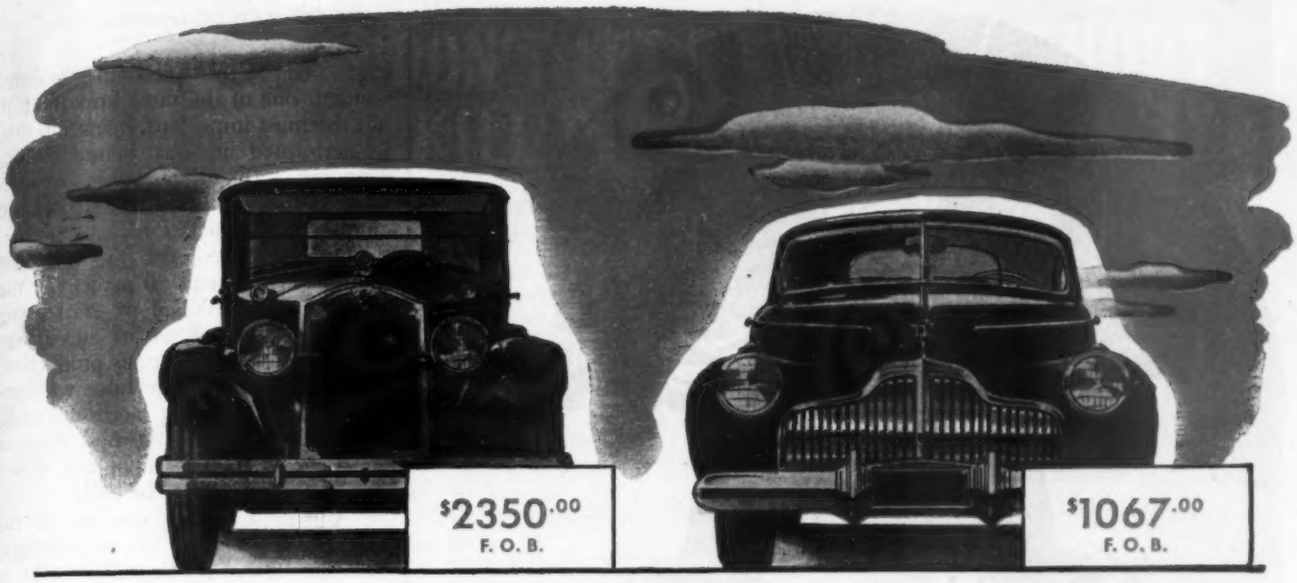
This is an added argument for a third shift bonus, which many plants have already instituted. With this bonus, the plant can choose its personnel and better balance the skills on the third shift, including supervisors.

Authorities are not in agreement on the periods of shift rotation. Most of them favor periods of longer than 30 days before changing. Regardless of the length of the night work cycle, the worker should stress regularity during that period, or during periods between off days. Authorities agree that the number of night workers should be reduced to the minimum. In addition, they stress that good lighting, safe and healthy working conditions, and adequate eating and first aid facilities are even more important than they are on the other shifts. There are no indications of impairment of health due to night work. Health dangers, rather, lie in too long periods of night work, tending to cause cumulative fatigue; too short periods, not allowing time for proper adjustment; carelessness in bodily care; irregularity of eating or sleeping; and neglect of any of the safeguards as outlined here.

•

Importance of Maintenance in Industry

"We can always learn something from the other fellow," said H. R. Meyer, manager of the maintenance department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, in a recent talk before the Electrical Maintenance Engineers of Chi-



OBJECT LESSON: from Detroit

A timely reminder to businesses seeking a stronger position in their industries—in the period ahead

REMEMBER, after World War I—how certain automobile manufacturers pulled ahead, while others went into reverse?

Some were quick to take advantage of the modern mass production methods that were being developed. Others were not.

Those which succeeded in reducing non-productive costs, were able to put a better and better product within reach of more and more pocketbooks. Their profits clicked into high gear. And the national economy hitchhiked right along with them. Pay checks also fattened. Millions of new jobs were created.

Another Opportunity Is Waiting Today

But this is 1945. Where can you look, today . . . and tomorrow . . . for cost reductions that will enable you to produce *more for less?*

Where? Relatively few businesses have yet discovered it. But it's probably the most promising area for the application of work simplification that exists, today. *In written systems of control. In office and plant paper work.*

Costs Swollen to Four Times Their Former Size

You get *some* idea of the potential savings when you learn that direct paper-work costs have almost quadrupled since 1900. But consider that systems of control affect every physical activity of business and industry . . . and you'll see that inefficient paper work *multiplies itself* throughout every office and factory operation.

The system procedure, the writing method, the form design that wastes time, can lead to waste of materials, manpower and machines reaching staggering proportions.

What Can Be Done About It?

Here's what a New England manufacturer did about it. As a result of analysis with The Standard Register Company's aid, a new tool manufacture order system and procedure were developed. Paper work was immediately reduced (one record replacing three), *with a toolroom saving of 4,000 man hours a month.* And the tool delivery schedule was reduced from *seven weeks to one.*

An unusual case? Perhaps. But The Standard Register Company, through its broad experience, unique facilities and sound techniques, has helped effect five- and six-figure savings for hundreds of leading companies. This service is thorough, methodical, follows a step-by-step plan which gets at the basic problems and finds the answers with the greatest possible speed — and without upsetting your office routine.

Would you like to know more? WRITE TODAY, for our new, informative folder, "The A-B-C's of Work Simplification," together with sample Formcraft Digest and outline of over 50 specific cases of cost saving through scientific form and system improvement. Or ask us to send a representative to discuss your problems.

THE STANDARD REGISTER COMPANY

Manufacturer of Record Systems of Control for Business and Industry

DAYTON 1, OHIO

Pacific Coast: Sunset McKee-Standard Register Sales Co., Oakland, California. Canada: Crain Printers, Ltd., Ottawa. London: W. H. Smith & Son, Ltd.

PORTER HAND POWER CUTTERS

These tools go *to* the job and are used *on* the job independent of any power source — except a worker's two hands. This power is so multiplied that an average worker can exert sufficient pressure to " lift an elephant —."

This power delivered at the working head finds many applications in metal cutting and fabricating — emergency, repairs, on construction, snop or production.

The illustration above shows a Porter Bolt Clipper head cutting a 5/8" annealed bolt in the thread. In addition to standard tools for cutting wire, cable, chain, flat bars, splitting nuts, etc. there are special tools for Heading, Pressing, Crimping, Punching, Caulking.

FREE Write for Free copy of Tool Maintenance Book boiled down essence of practical experience in use and care of clippers, saws, chisels and other hand tools. A post card request will bring it postpaid. *Also write for catalog of Porter line of Cutters.*

H. K. PORTER, INC., 426 Ashland St., Everett 49, Mass.

PORTER HKP CUTTERS

cago. "To me this question of maintenance is one of the most important, if not the most important, operation that is performed in our manufacturing economy. In other words, maintenance is the beginning, and its lack the ending, of all operations.

"Once we recognize the fact that motion means wear, 50 percent of the battle is won. When we start doing something about it, we are on our way to more or less continuous production. For many years maintenance was considered one of those necessary evils, and, as a rule, when business dropped off and expense had to be cut, it was one of the first items to be hit.

"Andrew Carnegie was one of the first real exponents of maintenance. Whether it was his Scotch ancestry or his inherent business ability, I can't say, but I do know that in time of relatively good prosperity he set aside money for overhauling his buildings and equipment during dull times.

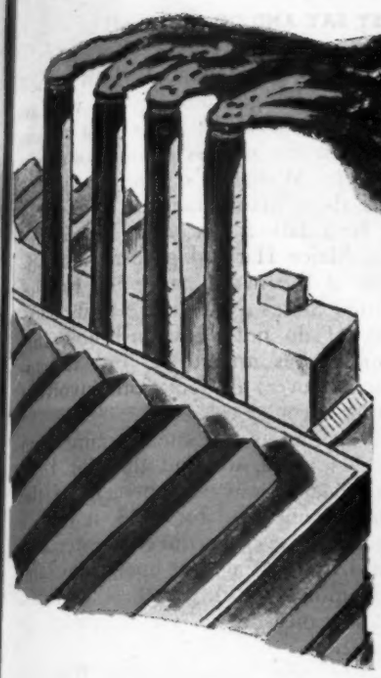
Progress From War

"Out of all wars, destructive as they are, comes much progress from a material standpoint. Out of this one, among other things, will come, I believe, a greater appreciation of the need for good maintenance. The lesson this time was learned the hard way. Machines had to be maintained because in most cases new ones could not be bought, and we had to make what we had do.

"One of the best examples of what real maintenance means in obtaining a desired end has been brought out by this war. Have you stopped to realize what a tremendous job it is to service the billions of dollars' worth of equipment we are shipping to many parts of the world? You no doubt have read about the complete rebuilding of planes in the wild jungles, the thousands of depots that must be set up to maintain our equipment under the worst conditions, and the millions upon millions of parts that must be ready at a moment's notice.

"It was and is a common expression that an Army travels on its stomach. Well, with the speed at which it travels today, it takes machines and maintenance of these machines to get that Army there intact. Food may go with the Army, but maintenance must follow closely after. While to the fighting men goes the credit for winning wars, it is the maintenance men who make that success possible. This, in my estimation at least, is true whether the maintenance men are at the front or at home.

"What are we talking about when



DON'T LET PRE-WAR METHODS KILL POST-WAR PROSPERITY!

The war years have proven to American Industry that the light machine tool has an important place in Production. Walker-Turner machine tools have demonstrated their ruggedness under most exacting conditions.

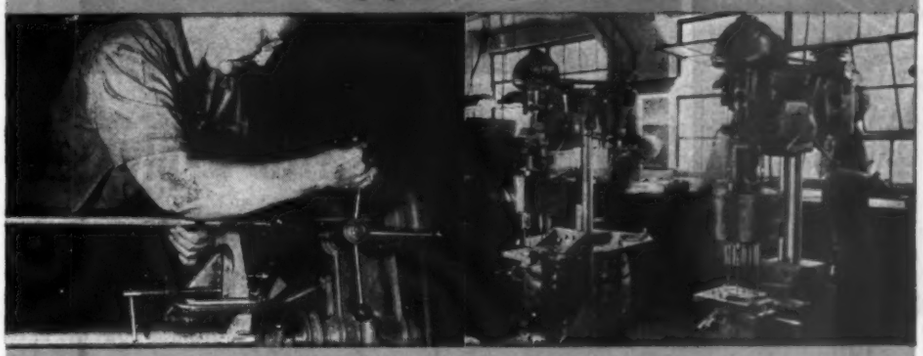
Don't let pre-war operating methods affect your post-war competitive position. The versatility of Walker-Turner machine tools will ensure production equal to—and, in many cases. better than—heavier and more expensive equipment.

WALKER-TURNER COMPANY, Inc.
Plainfield New Jersey

HERE'S HOW WALKER-TURNER MACHINE-TOOLS CUT COSTS!

260-5200 R.P.M. 60-5300 S.F.M. 160-8300 R.P.M.

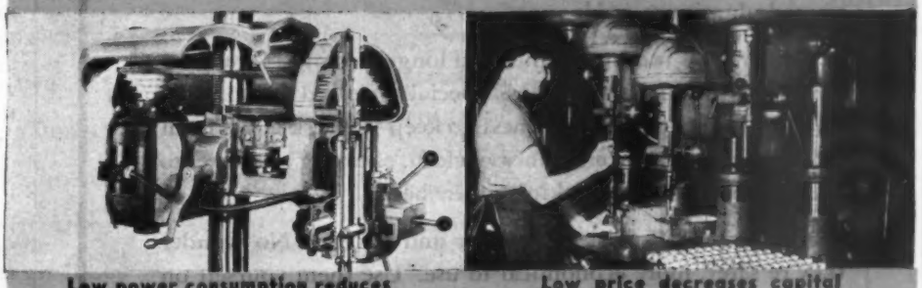
Wide range of operating speeds enables you to select the optimum cutting speed for any material.



Walker-Turner flexibility saves time and cuts costs in special tooling set-ups.

Set up horizontally, this Walker-Turner 15" Drill Press flares the ends of tubing.

This Walker-Turner 22" Drill Press drills five holes and reams two holes in one operation.



Low power consumption reduces operating costs.

This motor on a Walker-Turner 20" Drill Press provides speeds for drilling up to ¾" in steel, 1" in cast iron.

Low price decreases capital investment.

This Walker-Turner 4-spindle 20" Drill Press costs no more than a single heavy unit, yet has several times its production capacity.

walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

Cut time-outs with 3-ply

WELDISKS!

Tough! The grit on Weldisks is the toughest, longest-lasting abrasive in commercial use. It's made of electric furnace treated aluminum oxide.

What makes it even tougher and longer-lasting is a unique 3-ply backing: 1 layer of fibre, specially treated and pressed for double strength and hardness, to keep Weldisk edges from going "flabby"; 2 layers of heavy cloth, encasing the fibre, to keep the fibre from cracking when bent.

No wonder Weldisks cut faster and longer! No wonder they're safer, more economical to use. Use them yourself on all tough grinding jobs – *the tougher the better with Weldisks!* Available in all grits 320 to 16.

Abrasive Products, Inc.

SOUTH BRAINTREE 85, MASSACHUSETTS · MAKERS OF JEWEL COATED ABRASIVES

we discuss maintenance? Is it something to be got out of the way as quickly as possible, or is it a major factor in the success of our country's future? Well, let's consider a few facts about maintenance in general.

"In a talk a few years before the war, Major Harbard gave as his estimate of the maintenance bill for the United States a figure of $5,000,000,000. I do not know just how this amount was arrived at, but it supposedly covers all operations involving maintenance. . .

"Looking at the same picture from another angle, we find that for 1936 maintenance was 30.5 percent of the total income, and for 1943, it was 28 percent. In every business maintenance is a direct cost against operations, and the amount of this cost is in many cases a measure of the efficiency of operation.

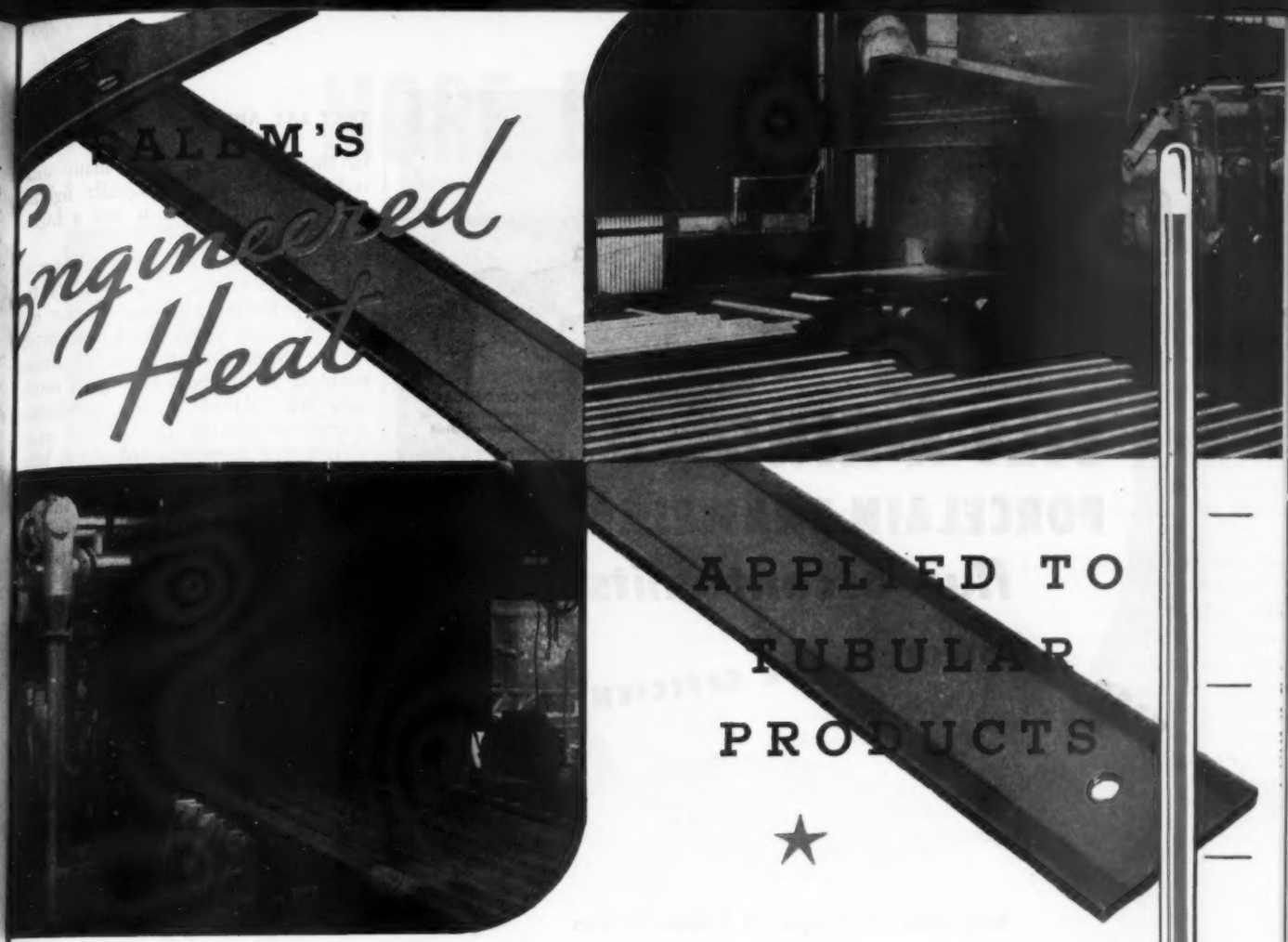
"For one manufacturing firm on which a maintenance study was made, it was found that maintenance was 3 percent of the total billings. This was a rather large manufacturing operation, and I feel that the figure may run somewhat lower for smaller plants. . .

A Big Business

"All of these figures are for all classes of maintenance normally found in manufacturing operations. . . It should be quite evident that maintenance in this country is not only a vital necessity, but also a big business. . .

"We now come to that important question, What is maintenance and what constitutes its essential elements? While it might be defined in a number of ways, I like this one, 'Maintenance is that operation which, through inspection, repair, and replacement of parts, assures maximum life and production capacity.' In maintenance work, as it should be carried on today, there are among many details, two main functions which are essential if the best possible job is to be done. First, we have that item of prime importance, a complete maintenance set-up by the operator of the equipment, and second, the part that the manufacturer plays.

"With the highly competitive market which exists on most fabricated items, it is obvious that constant research work must be carried on. That such research will not only continue, but also must be intensified, is indicated by the speed at which we are now using up our natural resources. We must start soon to consider the more efficient use of materials or on some elements we may find ourselves



SALEM'S Engineered Heat

APPLIED TO TUBULAR PRODUCTS

★

THE REQUIREMENTS—A furnace for draw tempering and normalizing steel pipe, 2 to 14″ in diameter.

THE DESIGN—Horizontal cylindrical type—100′ plus in length.

THE FEATURES—Roller driven hearth; burners firing tangentially into the chamber, providing a rapid, swirling action; two 100′ roller tables at either end; five automatic recording temperature zones in the heating chamber; a rayotube instrument which continuously charts the temperature of all tubes being discharged; two-man operation.

RESULTS—Furnace changes from draw temperature to normalizing temperature in one hour and reverses the change, high to low, in two hours. When normalizing, the furnace heats about 20 tons of pipe in one hour and 18 tons when only draw tempering is required.

Salem combines engineering with economics in designing furnaces to suit specific heat treating requirements. We call this service—

SALEM'S Engineered Heat

NOTE — War production has spurred many sensational developments in heat treating, particularly in controls, quenching and fitting the parts to the method. Salem engineers will be glad to discuss these advances with you

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SALEM ENGINEERING COMPANY

"ECONOMICAL"
Fluorescent
Industrial Unit
SILV-A-KING
PORCELAIN ENAMELED
fluorescent units
KEEP ON GIVING MORE EFFICIENT LIGHT!
Long after other types of fluorescent units have lost their ability to deliver their original high standard of illumination, SILV-A-KING equipment will still be there . . . lighting the way to higher production. It's the kiln-fired Porcelain Enameled finish that does the trick. What's more, SILV-A-KING units cost less to maintain than any other lighting fixtures on the market!
"SPECIFICATION"
Fluorescent
Industrial Unit
Write for Bulletins 44FE and 44FS describing the "Economical" and "Specification" units.
SILV-A-KING
LIGHTING EQUIPMENT
BRIGHT LIGHT REFELECTOR COMPANY
Metropolitan & Morgan Avenues, Brooklyn 6, New York

in the same position as many small nations who are continually fighting for a place in the sun and a higher standard of living.

"While war is a great waster of natural resources, it also starts the creative juices working to the end that man may always have a substitute for the things that are gone. A shining example is the part that glass insulation has played in our production operations during the past 3 years. While this item was not a war baby, it will play a great part in that after-war conservation period. With the difficulty in obtaining that other important item, asbestos, glass has really saved the day. . .

What Glass Can Do

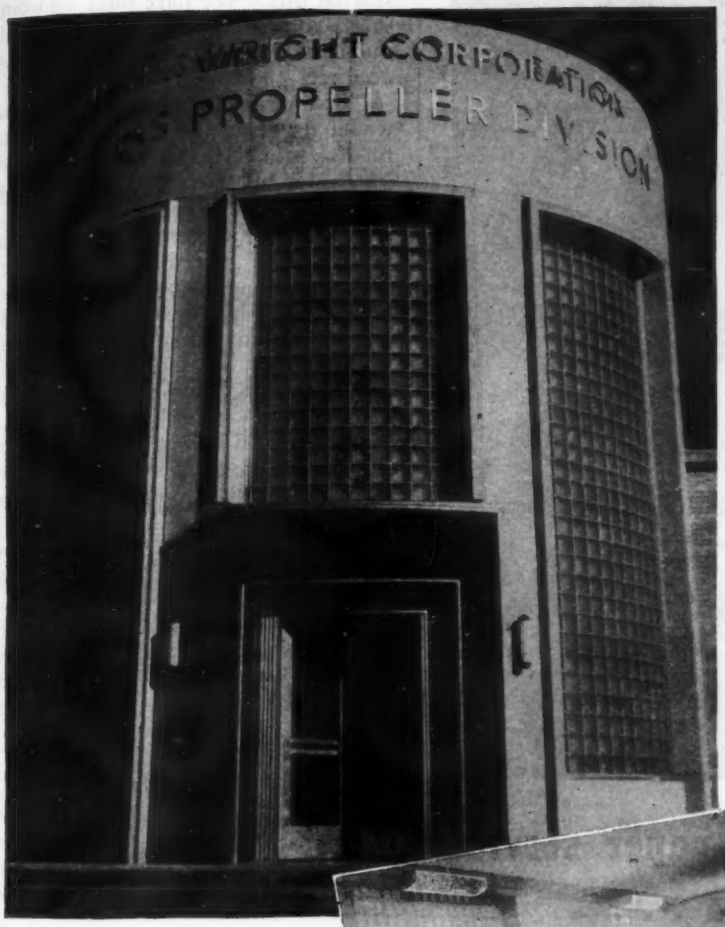
"Glass as an insulating medium has been with us long enough for most of the kinks to be ironed out and to provide us with data as to what we can expect. In the war effort its use has permitted the production of motors for special purposes that could not otherwise have been made. It is this angle that is going to be of great aid in conserving materials in the post-war period. Before the present war, the average temperature for general industrial motors was only 26 deg. C. Just imagine the possibilities in that field.

"As we tend toward higher operating temperatures, it is obvious that other parts of the motor, as well as the coils, must be taken care of. Where it is found necessary for various reasons to operate commutator motors at temperatures higher than normal, other means than our everyday solders must be found for connecting the armature leads to the commutator necks. Fortunately a material has already been developed for this purpose, and means for its application are available. . .

"The spraying of metals for the purpose of building up worn parts, while not a product of this war, has nevertheless been a great blessing. Through this process many parts which could not be replaced have been made usable. Machines which would otherwise have been lost have been kept available to produce war materials. It is not my intention to go into the technical side of such operations, but rather to point out some of those important items which have made better maintenance possible.

"Many foreign boats, including submarines, have come into our ship and navy yards for complete overhauling. These boats have very few spare or renewal parts. If it were not for metal spraying, much time would be

MORE DAYLIGHT with PC GLASS BLOCKS



A unique combination of practical qualities and fine appearance . . . that's what PC Glass Blocks have to offer. Exterior panels of PC Glass Blocks are attractive, they admit plenty of daylight, yet preserve privacy. Their insulation properties make buildings easier to heat.

THE light-transmitting ability of PC Glass Blocks is only one of the reasons why they are so generally used in plants, factories and administration buildings, in outer walls and in partitions.

For PC Glass Blocks also have valuable insulating properties. They prevent heat losses, exclude distracting sights and sounds, protect workers, machines and goods in process from dust and moisture.

In addition, PC Glass Blocks effect worthwhile economies. Less artificial lights, less heating cost, less repairs and replacements, less cleaning time—all add up to important savings.

In the many industrial modernizing and building programs now in prospect, PC Glass Blocks will play an essential part. Now is the time to get full information on the wide range of sizes and patterns, the special functions, of PC Glass Blocks. Pittsburgh Corning Corporation, Pittsburgh 22, Pa.

Also manufacturers of PC Foamglas.

In banks and other public buildings, large panels of PC Glass Blocks supply ample diffused daylight. Their insulating properties ease the load on heating and air-conditioning systems. Flat surfaces are easily cleaned.

In all sorts of processing plants, PC Glass Blocks provide floods of daylight. They protect precision machinery and goods in process from gritty dust, prevent condensation, help to maintain temperature and humidity levels.

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GLASS BLOCKS

Distributed by

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632 DUQUESNE WAY, PITTSBURGH 22, PA.

FILL IN AND MAIL THE CONVENIENT COUPON AND YOU WILL RECEIVE A FREE COPY OF OU LATEST BOOKLET, WHICH TELLS ARCHITECTS HOW PC GLASS BLOCKS HELP TOWARD BRIGHTE MORE LIVABLE QUARTERS—AND KEEP EXPENSES DOWN TO ROCK BOTTOM.

Pittsburgh Corning Corporation
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even the cost factor favors paper service in the plant cafeteria . . .

Dixie Cups for portion control . . . for serving hot and cold drinks . . . for soup and stew . . . for puddings and other desserts—speed up service over the counter. They also speed up the change-over clean-up between feeding of the shifts.

Add to that, the saving in labor, making what you have go further. They relieve the dish-washing bottleneck.

The use of Dixies helps reduce sick-absenteeism by eliminating much of the chance of contagion.

Top it off with the downright *economy* of Dixie paper service and you have a set-up that warrants careful consideration. It's the modern method of in-plant feeding.

CAUTION: Dixie Cups are being so widely used by the armed forces and war plants that there just aren't enough to meet the demand on certain sizes. So if you cannot get the cups you want, we hope you'll understand.

★

Dixie and Vortex Cups are made at Easton, Pa., Chicago, Ill., Darlington, S. C., and Toronto, Canada.

DIXIE CUPS

DRINKING CUPS AND FOOD CONTAINERS

lost in making such parts or replacing with complete machines, most of which would no doubt be on the restricted lists. We have built up worn shafts, bearing fits in housings, and numerous details where wear has occurred.

"Transportation in our major cities would have suffered had it not been for this idea. Bus parts at times were impossible to obtain. In a great many cases they have been reclaimed. The journals or railway car axles have been built up and ground to original size. Many of you no doubt could add many items to this list, including the building up of impellers of pumps with stainless steel, sliprings of a.c. motors and generators, and so on to the end of the list.

"Here again we have an item for new applications as well as maintenance work. It also is not a new idea, but war necessity brought out a method of splicing which gave it considerable prominence. While cotton belts have been used for certain drives where its characteristics gave the desired results, there has always been difficulty in obtaining a splice which would hold and at the same time incorporate flexibility.

"After many trials and failures, a splice has been developed which provides long life with economy in operation and maintenance. It is of particular importance in high speeds, and has helped solve the problem brought about by the lack of leather.

For Quick Drying

"With infra-red heat lamps it is possible to perform a number of drying and baking operations which heretofore required rather extensive oven installations. It does not, for many operations, replace oven baking, but it can be considered as an adjunct for many problems where an oven is not available. Again, it can be used when an oven would not be feasible. As it provides a radiant heat rather than one of convection, greater immediate penetration is obtained with consequent shortening of the baking period.

"Great flexibility of set-up is possible because the source of heat is of such size that any number can be assembled to meet a given need. With a given bank or assembly of lamps, heat can be applied as and where needed by means of wiring and switching arrangements. This method of obtaining spotlight heat has been with us long enough so that there are on the market numerous designs of racks and fixtures to take care of most requirements.

"Over the years much has been

THE NUT THAT UNTHREADED *Locks* ON STUDS!

Thirty-eight SPEED NUTS are pushed over integrally molded plastic studs in this radio panel assembly, eliminating threaded inserts, reducing mold costs and assembly time.

In fastening insulation to floor board in trucks built by the White Motor Co., SPEED NUTS 1-1/4" square pushed over No. 11 nails eliminate large washers or retaining strips.

THE BASIC PRINCIPLE
of Spring-Tension Lock is
Embodied in all Speed Nut Designs

● Just a push and it locks! It's just as simple and easy as that! For this unique spring steel fastener needs only to be *pushed* over rivets, nails, tubing, wire, integral die cast or plastic studs to lock parts firmly together. Threads are unnecessary because the spring prongs of the nut provide a friction *lock* on even the smoothest of chrome surfaces.

But easy attachment is not the only advantage gained by using Push-On type SPEED NUTS. Costly threaded inserts, drilling and tapping are eliminated—molding costs reduced—assembly speeded up—and vibration loosening prevented. These fasteners are available in many sizes and shapes . . . rectangular, square, round, or they may be specially designed to fit your particular requirements.

If you want to improve the attachment of name plates, emblems, trim strips, grilles, or other light-weight parts, write now for samples of Push-On type SPEED NUTS, giving *stud diameter* and any other pertinent assembly details.

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Speed Nuts ★ PATENTED *Trade Mark Reg. U. S. Pat. Off.

FASTEST THING IN FASTENINGS

General view of installation.

Detailed view of dustless unloading device.

MAXIMUM EFFICIENCY IN DUST CONTROL SYSTEM

Above view shows a combined installation of preliminary cyclone and cloth screen dust control units collecting wood shavings, chips and fine dust from total air volume exceeding 125,000 cubic feet per minute. This installation serves the wood working operation in connection with the production of Gunstocks for U. S. Service Rifles. The system features dustless unloading of collected material and "heat" saving through return of cleaned air from cloth collectors to building.

PANGBORN

WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

learned about the manufacture and application of carbon and metal graphite brushes for rotating motors and generators. While this product still has its ups and downs, we know that in most cases relatively long life can be expected. . .

"Many of our machines operate in atmospheres encumbered with gases that are detrimental to good commutation. No doubt some of you have experienced so-called threading and grooving. While there are numerous causes for this condition, contaminated atmospheres contribute to a considerable extent. Tests which have already been conducted indicate that a specially treated brush will help solve the problem.

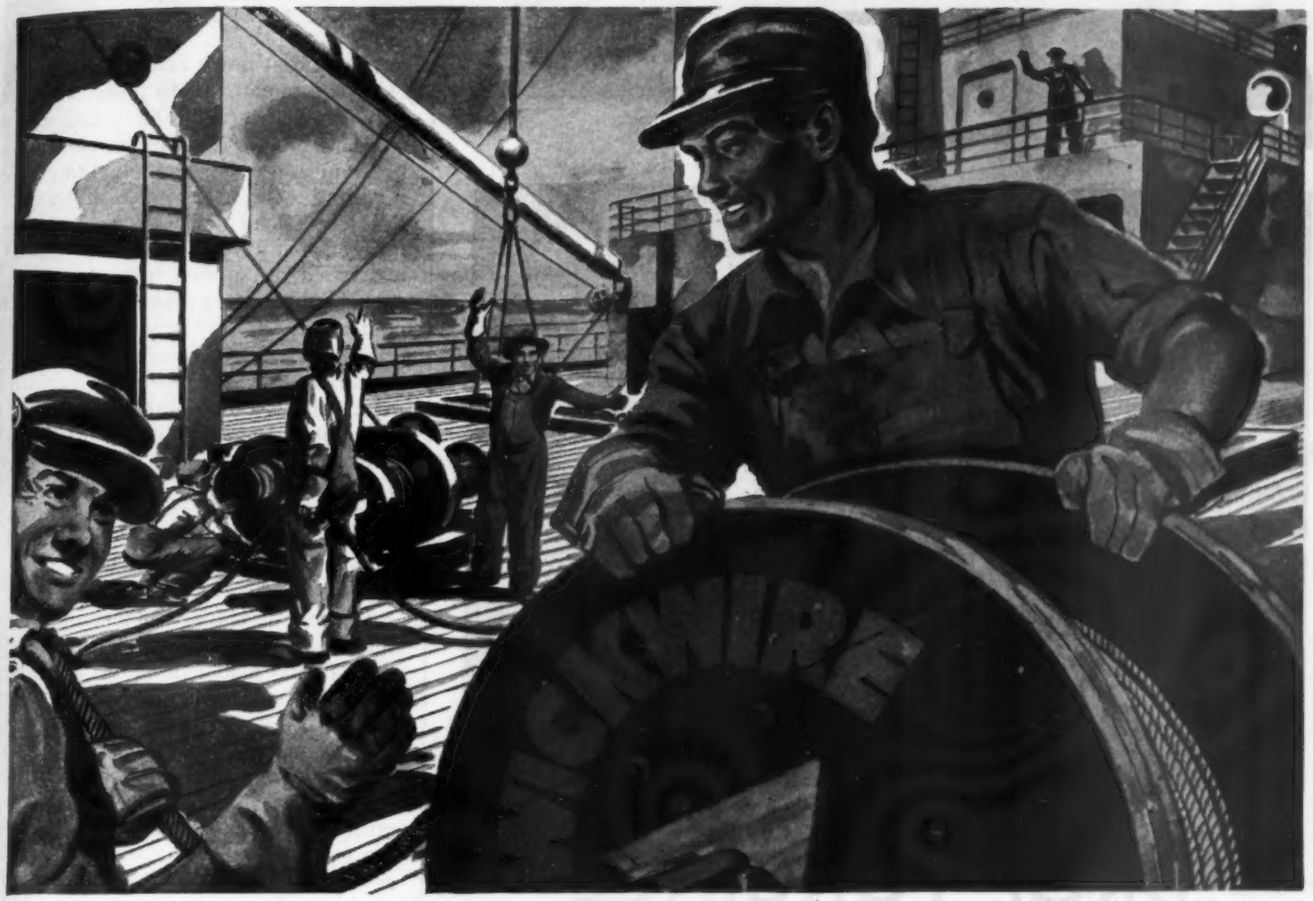
Lower Maintenance Costs

"In addition to these specific broad coverage programs for the improvement of maintenance operations, there are many detail improvements which also contribute to a lowering of maintenance costs. Many of these items are the direct result of troubles in the field over a period of years, and you men have contributed much in suggesting better ways of doing things which the designer sometimes overlooks.

"As with any contact of two parts carrying current, the ability to handle the current is not so much a question of mass as it is the number of points on each piece which meet each other, and the pressure applied. During the past several years a compensating finger has evolved, the design of which is such that the fingertip finds its own seat for maximum contact surface. Today this finger or its principle is standard on practically all controls, either for circuits carrying power or control currents.

"The design of this finger was the result of 21 tie-ups a week in the subways of New York. It was aided and abetted by one of the men in charge of car equipment. Since its adoption, trouble from this source has been almost entirely eliminated. Another case where trouble, and suggestions from maintenance men, led to improved design.

"During the past few years many protective devices have been used for motors and controls. One of the most common of all these items is the thermal cutout designed in many forms, but all based on the amount of current drawn by the operating equipment. Since it has been proved in practice that these cutouts have been a big asset in keeping production at a high rate when new motors and controls are involved, does it not stand



STOUT STEEL MUSCLES
for the Merchant Marine

The rigging for a typical cargo ship requires over 11,000 feet of wire rope, ranging in size from ¼ inch to 2¼ inches, and weighing over 10 tons. Scores of shipyards are building such ships—and using plenty of tough, dependable Wickwire Rope.

Oil fields, mines, logging camps, construction crews—and our fighting men abroad—also depend upon the stout steel muscles of Wickwire Wire Rope to do their heavy hoisting and hauling jobs. That's why—even with more equipment and working at full capacity 24 hours a day—we cannot keep up with the great demands for Wickwire Rope.

Since wire rope is harder to get, each length must be made to last longer. WISSCOLAY *Pre*formed Wire Rope, manufactured by Wickwire Spencer, not only lasts longer, but it's kink-resistant—easier to cut, splice and install—safer to handle.

If you have a wire rope problem our wire rope engineers will be happy to be of service. Call or write our nearest branch office or Wickwire Spencer Steel Company, 500 Fifth Avenue, New York 18, N. Y.

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Thousands of copies of "Know Your Ropes" have been sent to men in industry and the Services. Packed with ideas for making wire rope last longer this 82 page book contains 48 wire rope life-savers; 78 "right and wrong" illustrations, and 20 diagrams, tables, graphs, charts.

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SCREW MACHINE PRODUCTS • HEAT-TREATING
SPRAYED METAL SERVICE • PARKERIZING

We will gladly quote on your specifications.
Catalog on Request

RHODE ISLAND TOOL CO.
148 West River St., Providence 1, R. I.

Serving American Industry Since 1834

to reason that much can be done with older equipment not so protected?

A simple device used today with standard motors is simple in construction, and can easily be applied to existing equipment not now so protected. While overload devices have been in use for many years, their operation was based on sudden rises of current considerably above the starting and continuous values.

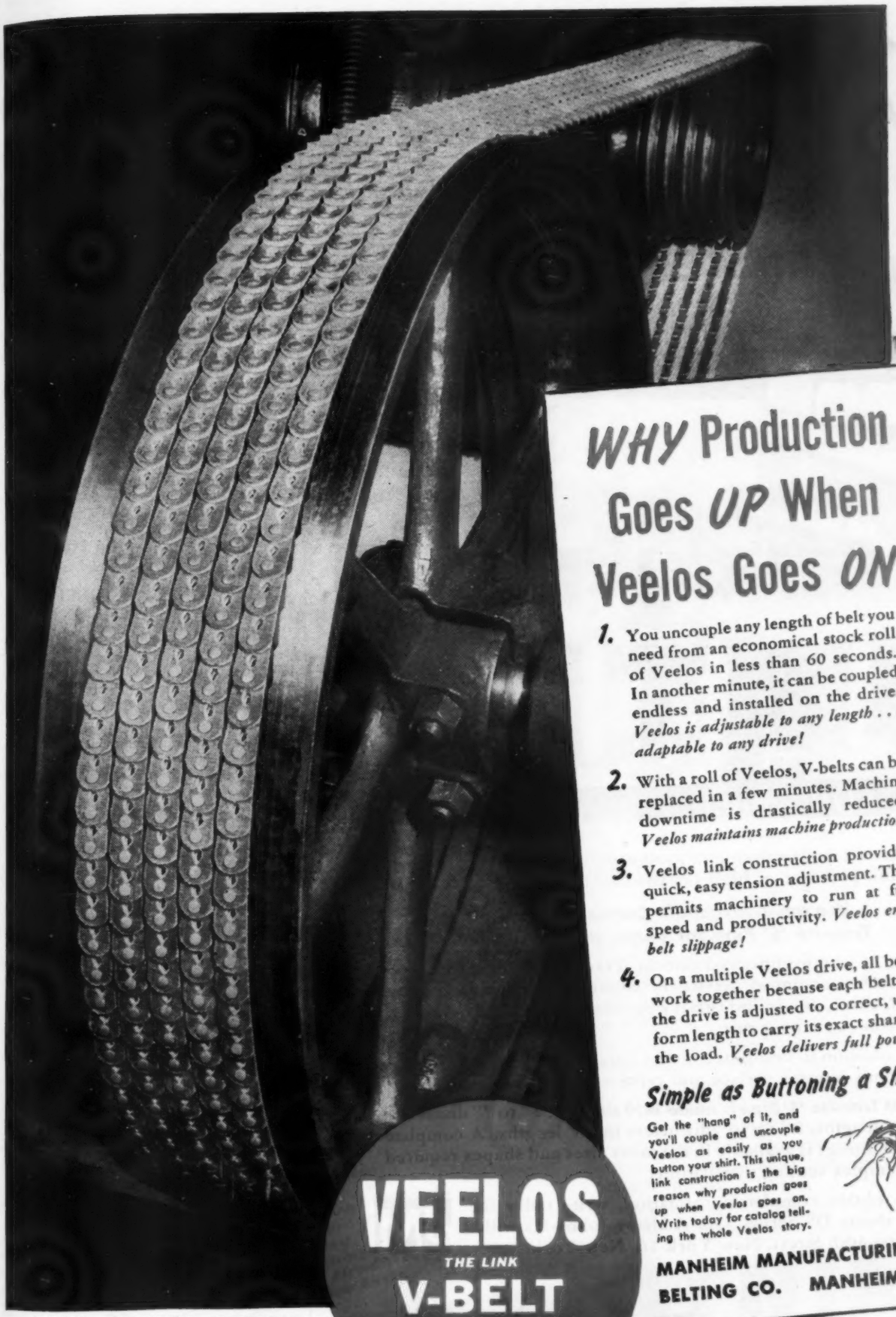
While a large percentage of protection is provided by these overload devices for sudden peaks, there is no protection against continuous overloads under the current setting of the trip. It is at this point that the thermal trip plays its important role. As a simple maintenance tool, there are few developments which have such widespread use as this device.

Whereas in the earlier machines the operating speeds were such that some unbalancing had little or no apparent effect, we have today an entirely different situation. With decreased size of motors, speeds have increased to a point where a slight amount of unbalancing spells ruin. Again, with our earlier machines practically all balancing was done under static conditions or in special cases on mechanical dynamic balancers, a lengthy and tedious process.

Today, through the miracles of electronics and allied research, we have a balancer which, with a few rather simple adjustments, permits almost perfect balance. A well-balanced machine, as all maintenance men know, means no vibration and hence less wear and longer life. With this and similar machines, balancing has become a production line operation instead of an individual research job.

To facilitate the detection of the source of vibration and its magnitude, there has been developed a simple hand tool about the size of a slide rule. It operates on the vibrating reed principle, with the period of vibration controlled by adjusting the length of the reed. As the length of the reed is changed by means of a thumbnut, an indicator on the shaft shows the frequency—just another advance for the maintenance profession.

Welding is an old idea made modern by the miracles of research, the improvement of metals, and the introduction of the electric method of producing good welds. It has changed the course of a complete industry replacing many castings with fabricated structures. Best of all, it has been the mainstay in bringing back to operating condition much of our machinery which would otherwise be lost to the productive world.



WHY Production Goes *UP* When Veelos Goes *ON*

1. You uncouple any length of belt you need from an economical stock roll of Veelos in less than 60 seconds. In another minute, it can be coupled endless and installed on the drive. *Veelos is adjustable to any length . . . adaptable to any drive!*

2. With a roll of Veelos, V-belts can be replaced in a few minutes. Machine downtime is drastically reduced. *Veelos maintains machine production!*

3. Veelos link construction provides quick, easy tension adjustment. This permits machinery to run at full speed and productivity. *Veelos ends belt slippage!*

4. On a multiple Veelos drive, all belts work together because each belt on the drive is adjusted to correct, uniform length to carry its exact share of the load. *Veelos delivers full power!*

Simple as Buttoning a Shirt

Get the "hang" of it, and you'll couple and uncouple Veelos as easily as you button your shirt. This unique, link construction is the big reason why production goes up when Veelos goes on. Write today for catalog telling the whole Veelos story.

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VEELOS
THE LINK
V-BELT

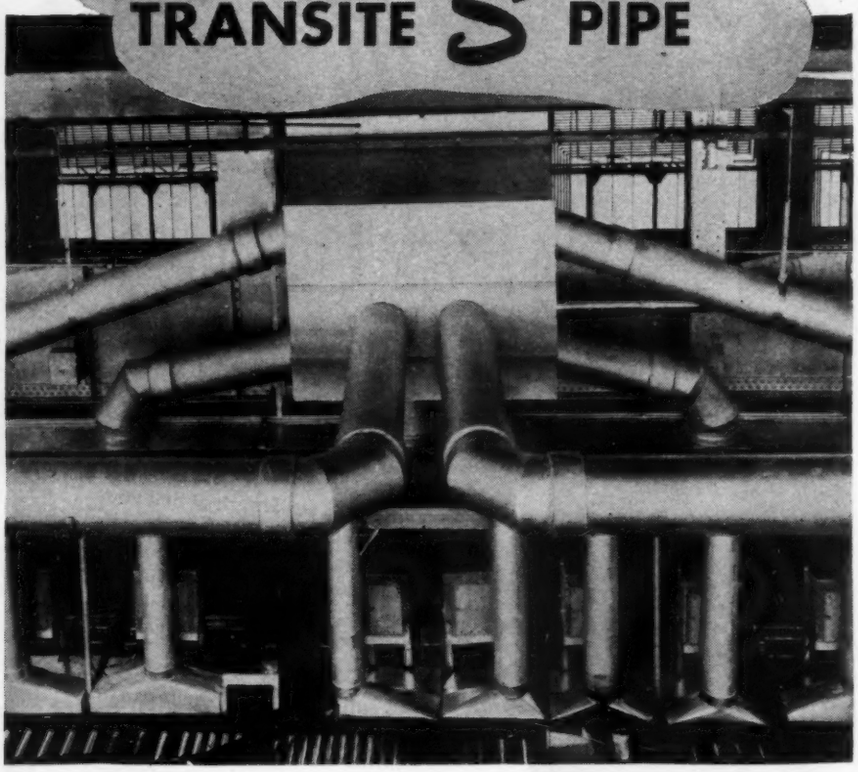
Adjustable to any Length
Adaptable to any Drive

LINK CONSTRUCTION UPS PRODUCTION

CARRY OFF *Fumes*

with corrosion-resistant readily installed

TRANSITE 'S' PIPE



● Here's a ready solution to most venting problems . . . including the problem of high installation and maintenance costs!

Use easy-to-handle Corrosion-resistant Transite 'S' Pipe for vents, ducts and stacks

Made of asbestos fiber and cement, Transite 'S' Pipe gives effective and economical service in venting most fumes, vapors, dusts, gases, etc. in industrial operations. It is highly weather-resistant . . . cannot rust.

In addition to being strong and durable, Transite 'S' Pipe has a smooth interior surface and relatively low-heat conductivity.

J-M Transite 'S' Pipe is made in 19 sizes . . . 2″ to 7″ diameters in 10′ lengths, 8″ to 36″ diameters in 13′ lengths. A complete line of fittings is available in the many sizes and shapes required for complex venting installations.

To obtain complete information, write today for data sheets DS Series 336. Address Johns-Manville, 22 East 40th Street, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE 'S' PIPE

BOOKS

DEMOBILIZATION OF WARTIME ECONOMIC CONTROLS

John Maurice Clark, Professor of Economics, Columbia University. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 219 pages. Index. $1.75.

A research study of the Committee for Economic Development. Deals with the many-sided question of demobilization of wartime controls. Presents a survey of the kinds of controls, their objectives, their wartime effect, authorization by which each exists, and so on; analyzes the varying circumstances under which need for them may abate; and offers specific recommendations for the time, manner, and degree of their cessation. In ten sections: "The Setting of the Problem"; "Main Findings and Recommendations"; "How Not to Reconvert"; "Objectives of Policy in War, in Reconversion, in Peace"; "The Framework of Wartime Controls"; "Economic Controls During Future Fighting"; "The Characteristics of Initial Post-War Reconversion"; "War Controls During Initial Post-War Reconversion"; "Immediate Problems of the 'Catching Up' Period"; "Controls in a Longer Perspective."

ARC WELDING ENGINEERING AND PRODUCTION CONTROL

Walter J. Brooking, Director of Testing and Research, R. G. LeTourneau, Inc. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 347 pages. Photographs, tables, figures, index. $4.

A manual of the arc-welding process as applied in manufacturing and fabrication. Discusses the significance of materials, fixtures, engineering control, process planning and organization, and other factors, and shows how to analyze them as a basis for the application of arc welding to specific manufacturing problems.

DEMOCRACY UNDER PRESSURE

Stuart Chase. The Twentieth Century Fund, 330 West 42nd St., New York 18. 142 pages. $1.

Subtitled "Special Interests vs. the Public Welfare." Fourth in the series of six reports on post-war problems. Shows how pressure groups are formed, how they operate, and their effect on the general welfare. Suggests how to deal with them, while curbing their abuses and excesses. In eleven chapters, plus an epilog, "Mountain Conference."

CARE AND USE OF HAND TOOLS

R. R. Toliver and W. C. Lewis. John Wiley & Sons, Inc. 440 Fourth Ave., New York. 93 pages. Drawings, index. $1.25.

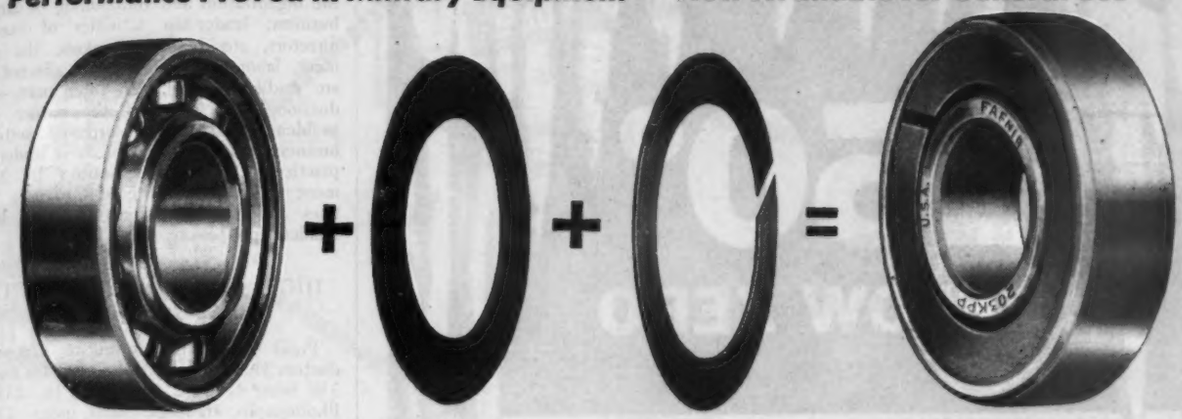
An elementary manual describing and illustrating the handling of common tools used in machine shops, suitable for beginning mechanics. Demonstration and discussion guide makes book useful for teachers. Tools covered, with a chapter devoted to each, include vises, hammers, cold chisels, files, screwdrivers, hacksaws, pliers and nippers, wrenches, torque wrenches, machine screw taps, drills, measuring tools, micrometers.

BUSINESS LEADERSHIP IN THE LARGE CORPORATION

R. A. Gordon. The Brookings Institution, Washington 6, D. C. 369 pages. Index of

FAFNIR PLYA-SEAL BALL BEARINGS

Performance Proved in Military Equipment • Now Available for General Use



Fafnir Standard Ball Bearing — Flexible Sealing Washer — Split Retaining Ring — FAFNIR PLYA-SEAL BEARING

POSITIVELY SEALED —SEALS EASILY REMOVED

THE result of five years of development and testing, PLYA-SEAL bearings have proved the most effective, self-protected bearings yet designed. Approved for aircraft by the Army Air Forces and the Bureau of Aeronautics U. S. Navy, Fafnir PLYA-SEALS have been in use successfully for over two and one-half years in aircraft control bearings and operating equipment. Several thousand bearings incorporating the double PLYA-SEAL have completely eliminated former difficulties with metal shielded bearings in textile machines.

Whether you are designing a new product or planning to resume production on an old one, you will find it very much worthwhile to investigate and test Fafnir PLYA-SEAL Bearings. Write for complete descriptive folder. The Fafnir Bearing Company, New Britain, Conn.

PLYA-SEAL takes its place among these other FAFNIR "FIRSTS" . . . Wide Inner Ring Ball Bearing with Self-Locking Collar; Seal and Shield Type Bearings; Compact Super-Precision Spindle Bearings; Compact Super-Position Retainers, Aircraft Ball Bearings, Rubber Pillow Blocks . . . and more.

WHAT IS PLYA-SEAL?

A diaphragm-type, contact seal comprised of two members – a flat, flexible sealing washer of synthetic rubber impregnated fabric and a split retaining ring of stainless steel.

Firmly held in the outer ring, the sealing washer does not rotate with the inner ring but is in contact with a ground groove to form a very effective seal with a minimum of friction.

WHAT ARE PLYA-SEAL'S ADVANTAGES?

1. Assures maximum retention of lubricant, maximum exclusion of dirt and liquids.
2. Causes no distortion of the outer ring or race, nor does it affect the concentricity of either the rings or races.
3. Forms a positive seal with the outer ring while maintaining perfect contact with the inner ring.
4. Non-capillary and impervious to liquids, grease, oil, gasoline, water and a wide variety of solvents. Not affected by heat or cold. Sealing washer does not deteriorate with age.
5. Easily removed and replaced to allow inspection, washing and re-greasing.

FAFNIR BALL BEARINGS

150°
BELOW ZERO

In a KOLD-HOLD electrical refrigeration cabinet you can process metal parts and tools consistently at closely controlled temperatures as low as 150 deg. below zero—much lower than can be attained by the use of dry ice and the lowest temperature yet commercially available. This unit is especially designed for hardening steel tools, making expansion fits on close tolerance assemblies, for experimental work, and for product research.

These cabinets are built in two sizes, one having a work capacity of 5 cu. ft. and the other a capacity of 11 cu. ft.

Write for further specifications and quotation.

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456 NORTH GRAND AVE. • LANSING 4, MICH.

KOLD-HOLD

companies and individuals cited, index of authors and subjects. $3.

Written for both the business man and the professional economist, with emphasis on the personal and volitional factor in business leadership. Analysis is based on a detailed study of the organization and functioning of large-scale business; leadership activities of executives, directors, stockholders, bankers, the government, labor, and certain other affected groups are studied in turn. In three parts—"Introduction," which covers the nature of the problem, the present corporate setting for business leadership, and business leadership in practice; "Business Leadership by Management and Outside Interest Groups"; "Incentives and the Professionalization of Business Leadership."

HIGH-FREQUENCY INDUCTION HEATING

Frank W. Curtis, Consulting Engineer, Induction Heating Corp. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 235 pages. Photographs, drawings, charts, index. $2.75.

Designed to furnish aid in simplifying the application technique of induction heating, and to acquaint the manufacturing executive and technician with the fundamental principles of induction heating as applied to the hardening of metal parts, as well as to the joining of metal assemblies. Nine chapters, including "Principles of Induction Heating"; "Types of Induction-Heating Equipment"; "Design of Induction-Heating Coils"; "Brazing, Soldering, and Joining"; "Hardening and Heat-Treating"; "Fixtures for Induction Heating"; "Miscellaneous Induction-Heating Applications"; "Designing for Induction Heating"; "Dielectric Heating."

PROVIDING FOR UNEMPLOYED WORKERS IN THE TRANSITION

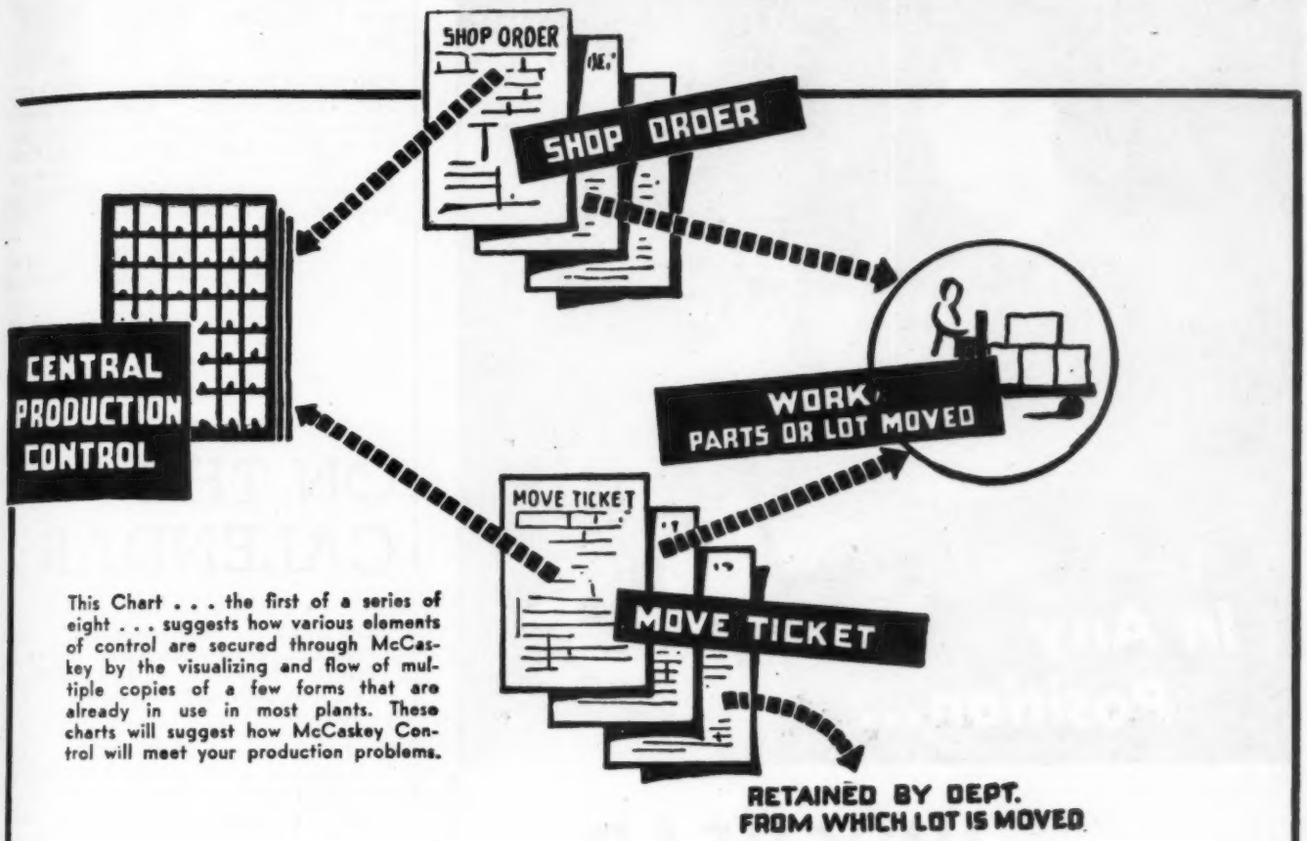
Richard A. Lester, Associate Professor of Economics, Duke University. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 152 pages. Chart showing data on unemployment by states, index. $1.50.

One of three studies by the Committee for Economic Development research staff. Written to answer the question: What should be done about the unemployment that occurs during the change-over from war to peace production? Among the factors examined are the adequacy of unemployment compensation to sustain purchasing power, the extent to which public works can be utilized for unemployment, the advantages or disadvantages of federal public works programs as against local undertakings, and the value of a transition period program of education and training for unemployed workers. Present programs are analyzed, and proposed programs are appraised.

BOOKLETS

INDUSTRIAL RELATIONS HANDBOOK. An account of the organization of employers and workpeople in Great Britain; collective bargaining and joint negotiating machinery; conciliation and arbitration; and statutory regulation of wages in certain industries. Ministry of Labour and National Service. His Majesty's Stationery Office, London. 260 pages. 3s.6d.

STUDIES OF THE EFFECTS OF LONG WORKING HOURS. Max D. Kossoris, Bureau of Labor Statistics. In two parts, Bulletins 791 and 791A. 94 pages (combined). Charts. Single copies may be obtained from The Bureau of Labor Statistics, Washington, D. C. without charge; more than one copy,



This Chart . . . the first of a series of eight . . . suggests how various elements of control are secured through McCaskey by the visualizing and flow of multiple copies of a few forms that are already in use in most plants. These charts will suggest how McCaskey Control will meet your production problems.

The ABCs of PRODUCTION CONTROL through McCASKEY SYSTEMS

Lower costs for post-war production will result directly from sound planning, scheduling, routing, machine loading, dispatching and follow-up . . . from intelligent use of the right production control system for your particular requirements.

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McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

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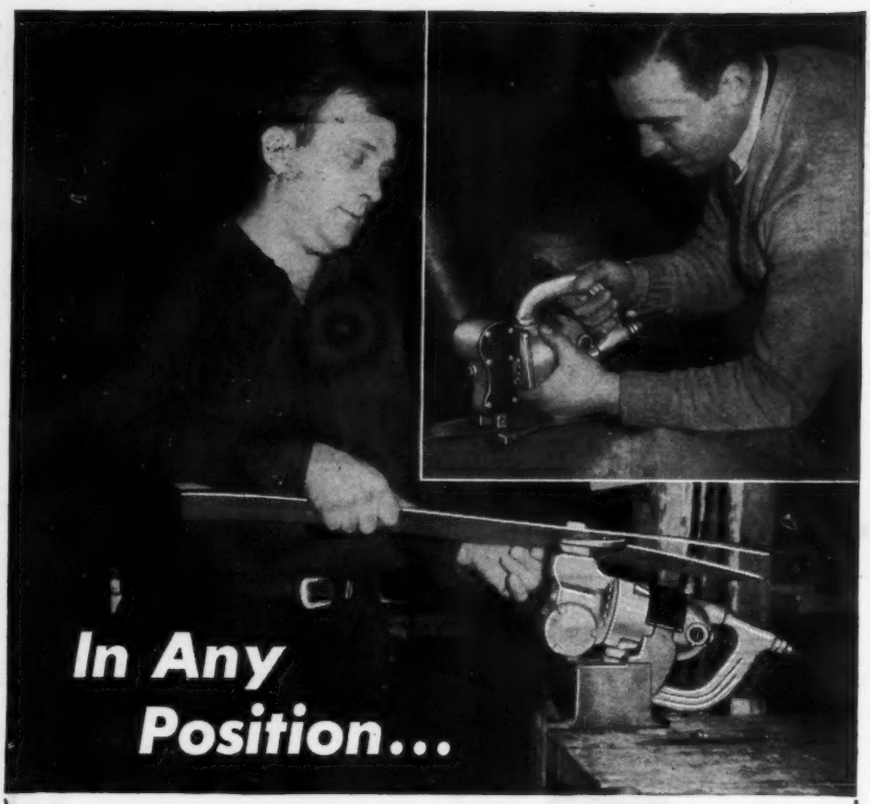

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PRACTICAL TECHNIQUES OF COLLECTIVE BARGAINING. Contract Clauses; Wartime Labor Relations; Management Before the WLB; Wage Controls and Wage Outlook. Personnel Series No. 86. American Management Association, 330 West 42nd St., New York 18. 48 pages. 75c.

EXCESS PROFITS TAX RELIEF: The Cyclical Provision. Joseph L. Snider, Professor of Business Economics, Harvard University. Business Research Studies No. 33. Division of Research, Graduate School of Business Administration, Harvard University, Soldiers Field, Boston 64. 30 pages. Tables, charts. $1.50.

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ON THE CALENDAR

MARCH

16–17, Society for the Advancement of Management, Spring Conference, The Drake Hotel, Chicago. Edward A. McTague, Executive Director, 29 West 39th St., New York 18.

20–22, Safety Engineers, 16th Annual Safety Conference and Exposition, Hotel Pennsylvania, New York. Paul F. Stricker, Executive Vice-President, Greater New York Safety Council, Inc., 60 East 42nd St., New York 17.

APRIL

3–5, Industrial Recreation Association, Annual Conference, Book-Cadillac Hotel, Detroit. Raymond Millard, Secretary, Purdue University, West Lafayette, Ind.

9–10, Midwest Power Conference, Annual Meeting, Palmer House, Chicago. Stanton E. Winston, Conference Director, Illinois Institute of Technology, 3300 Federal St., Chicago 16.

16–18, American Society of Mechanical Engineers, Spring Meeting, Hotel Statler, Boston. Ernest Hartford, Executive Assistant Secretary, 29 West 39th St., New York.

Meetings Canceled

American Society of Lubrication Engineers, First National Convention, scheduled for February 8-9, Chicago. B. H. Jennings, Secretary-Treasurer, 749 Field Building, 135 South La Salle St., Chicago 3.

American Management Association, Personnel Conference, scheduled for February 14-16, Chicago. James O. Rice, Conference Manager, 330 West 42nd St., New York 18.

National Metal Trades Association, Annual Convention, scheduled for February 26-28, New York City. Homer D. Sayre, Commissioner, 122 S. Michigan Ave., Chicago 3.

American Society of Tool Engineers, Annual Meeting, scheduled for March 19-23, Cleveland. Adrian L. Potter, Executive Secretary, 1666 Penobscot Building, Detroit 26.

International Lighting Exposition, scheduled for April 19-23, Chicago. R. W. Straud, Publicity Chairman, 222 North Bank, Chicago.

American Foundrymen's Association, Foundry Congress, 49th Annual Meeting, scheduled for April 30-May 4, Detroit. R. G. McElwee, Chairman of Detroit Chapter, 222 W. Adams St., Chicago 6.